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PROCEEDINGS ON THE WORKSHOPS ON TECHNOLOGICAL CHANGE IN THE U.S. AUTOMOBILE INDUSTRY OCTOBER 1977 THROUGH APRIL 1978 AND THE SYMPOSIUM ON TECHNOLOGY, GOVERNMENT AND THE AUTOMOTIVE FUTURE OCTOBER 19-20, 1978

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FINAL REPORT

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16. Abstract This is the final report on the proceedings of a series of meetings consisting of five workshops and a final symposium on Technology, Government and the Automotive Future. The purpose of the meetings was to explore the implications of technological change in the U.S. automotive industry in support of improved policy formulation to meet emerging national needs. Although the impetus for these changes originates in many different sources -- direct government policy, diminished energy resources, international competition -- the government policy itself is the single most important impetus for change in the industry. The meetings were designed to gather insight and understanding from those who have intimate knowledge about problems and opportunities for improvement, gained through their own direct involvement with this sector. While other programs have previously brought together particular agencies of the government with industry or other organizations to deal with selected problems, a unique objective of this program has been to engage a broader range of participants in a constructive effort to promote progress in a form that is consistent with national needs. Five workshops were conducted in the following areas: (1) Motor Vehicle Regulatory Process, (2) Consumer as a Factor in Motor Vehicle Innovation, (3) the Supply Industry as a Factor in Motor Vehicle Innovation, (4) Changing Incentives for Motor Vehicle Research and Development, and (5) Role of National and Multinational Corporations in Motor Vehicle Innovation. The five key issues emanating from these workshops were the federal R&D policy in the motor vehicle sector, product rating information for consumers, regulatory decision-making, regulation and international trade, and transportation policy.

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PREFACE

This activity was conducted under the Implementation of Innovation in the Motor Vehicle Industry Program (HS-928) with the sponsorship of Mr. Samuel Powell, III, Technology Assessment Division, Office of Research and Development, National Highway and Traffic Administration. The contract technical monitor was Robert C. Ricci.

The series of workshops and a final Symposium on Technology, Government and the Automotive Future described in these Proceedings were jointly sponsored by the U.S. Department of Transportation (DOT) and the Harvard Business School.

The preparation of the papers presented at the Symposium was jointly funded by the U.S. Department of Transportation and the Harvard Business School, and only those papers with government support are included in this text. The other papers will be available in a text-published by the McGraw-Hill Book Company.

The authors wish to acknowledge the advice and invaluable guidance provided by Dr. Richard R. John of the Transportation Systems Center, and William Devereaux of the National Highway and Traffic Safety Administration.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

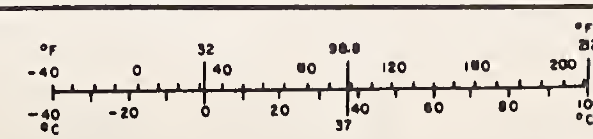

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

SECTION I

INTRODUCTION

I

INTRODUCTION

This is the final report on the proceedings of a series of meetings consisting of Workshops and a final Symposium on Technology, Government and the Automotive Future, which were held at Harvard University during 1977 and 1978. The meetings were planned and conducted by the Graduate School of Business in conjunction with faculty from the Harvard Law School; with contractual and administrative support from the U.S. Department of Transportation and Division of Research, Graduate School of Business, Harvard University. The purpose of the meetings was to explore the implications of technological change in the U.S. automotive industry in support of improved policy formulation to meet emerging national needs.

The schedule of meetings and their purpose is described in the first section of this report. The second section presents key issues that were identified in the Workshop sessions. The third and final sections discuss the planning, conduct and outcome of the meetings. Government-supported papers which were presented at the Symposium are included.

These meetings drew upon participants with a knowledgeable background in technical as well as policy issues, from organizations within the major sectors that have a vital interest in the U.S. automobile industry: Executive, Administrative, and Congressional branchs of government; consumer groups; industrial suppliers; dealer, insurance, financial, and service organizations; organized labor and the

automotive manufacturers themselves, both domestic and foreign.

Six different meetings were held, each on separate dates and subjects as noted below. The first five were focused Workshops, or round-table discussion sessions, which were held from October 1977 through April 1978 and which led up to the sixth meeting, a two-day public Symposium on October 19 and 20, 1978. See Table 1. The Symposium invited presented papers, addresses, and discussion of issues identified in the Workshop sessions. All meetings were held at the Graduate School of Business, Harvard University. The Workshops were informal meetings which focused on specific areas with the purpose of identifying policy issues pertinent to these areas. The public Symposium involved formal sessions and invited papers on Workshop issues as a first step in policy analysis of these issues. Both Workshop issues and Symposium proceedings are reported in this document.

The Agenda and program for the Symposium is given in Exhibit 1 which follows. All moderators, discussants and speakers are identified by session.

Purpose

The U.S. automobile industry is entering a period of technological and structural changes which is unprecedented in any mass production industry of such vital importance to the economy. The impetus for these changes originates in many different sources: direct government policy, diminished energy resources, international competition, social and legal trends, etc. Many contend, however, that government policy itself is the single most important impetus for

Table 1

Meetings, Subjects and Dates

A.	Workshops on Technological Change in the U.S. Automobile Industry	
	1. The Regulatory Process	October 21, 1977
	2. Consumer Implications	November 18, 1977
	3. The Changing Incentives for Research, Development and Innovation	March 10, 1978
	4. Supply Industry Issues	April 6, 1978
	5. International Issues	April 27, 1978
B.	Symposium in Technology, Government and the Automotive Future	
	Sessions:	
	Strategic Choices	October 19, 1978
	Consumer Implications	October 19, 1978
	Improving the Regulatory Process	October 19, 1978
	Promoting R & D Effectiveness	October 19, 1978
	Toward More Effective Regulation	October 20, 1978
	Innovation and Regulation	October 20, 1978
	Market Incentives and the Consumer A. Products Liability B. Consumer Choices	October 20, 1978
	International Trade and the Automobile	October 20, 1978

Exhibit 1

Symposium on Technology, Government & The Automotive Future

October 19-20, 1978

Thursday, October 19

1:00 - 1:45 PM Registration/Burden Hall

2:00 - 3:00 PM Introductory speakers/Burden Auditorium 20

Prof. Richard S. Rosenbloom, Associate Dean for Research and Course Development, Harvard Business School

Honorable John J. Fearnsides, Deputy Under Secretary, U.S. Department of Transportation

Dr. Umberto Agnelli, Vice Chairman and President, FIAT

Honorable Ray Thornton, Democrat, Arkansas, and Chairman, Science, Research and Technology Subcommittee

3:15 - 5:30 PM McCollum Center

1.

STRATEGIC CHOICES

Moderator

Prof. Joseph L. Bower
Harvard Business School

Papers

Prof. Douglas Ginsburg
Harvard Law School
"Making Automobile Regulation Work: Policy Options and a Proposal"

Dr. Richard John
Dr. Bruce Rubinger
Mr. Robert Ricci and
Mr. Philip Coonley
Transportation Systems Center
U.S. Department of Transportation
"Promoting Socially Beneficial Technology: The Case for Automotive Regulations"

Mr. Kirk O. Hanson
Harvard Business School
"The Impact of Fuel Economy Standards on Corporate Strategy in the Automobile Industry"

2.

CONSUMER IMPLICATIONS

Moderator

Mr. Eric O. Stork
Visiting Fellow in Technology and Public Policy
A.A. Potter Engineering Center
Purdue University

Papers

Mr. Robert Berke
Executive Director
National Association of Fleet Administrators, Inc.
"The Response of Fleet Owners to Regulation-Induced Technical Changes in Car Design"

Mr. Howard M. Bunch
Manager
Transportation Research Projects
Highway Safety Research Institute
University of Michigan
"The Small Car May be Dangerous to Your Health: The Consequences of Downsizing"

Discussants

Mr. Robert J. McCabe
Director, Treasurer's Office, Administration Section
General Motors Corporation

Mr. Timothy Nulty
Senate Committee on Commerce, Science and Technology
Science and Transportation Subcommittee

Mr. Richard H. Shackson, Director
Environmental Research Office
Ford Motor Company
"Regulatory Ripple -- A Case Study"

Discussants

Mr. Clarence Dittlow
Center for Automobile Safety

Mr. Donald Randall
Washington Representative
Automotive Service Councils

5:30 - 7:30 PM Cocktails/McCollum Lounge
Dinner/Faculty Club, Kresge Hall

7:40 - 9:40 PM McCollum Center

3.

IMPROVING THE REGULATORY PROCESS

Moderator

Prof. Thomas K. McCraw
Harvard Business School

Papers

Prof. D. Quinn Mills
Harvard Business School
"The Techniques of Automotive Regulation: Performance Versus Design Standards"

Dr. Ulrich Seiffert
Chief Safety Engineer
Volkswagenwerk AG
"Obsolete Regulatory Standards

Discussants

Mr. James F. Gage
Vice President, Engineering
Prestolite Electrical Division

Visiting Prof. Allan Morrison
Harvard Law School

4.

PROMOTING R&D EFFECTIVENESS

Moderator

Dr. Francis W. Wolek
Deputy Assistant Secretary for Science and Technology
U.S. Department of Commerce

Papers

Dr. Norman Alpert, Manager
Environmental Health Programs
and
Dr. Eugene Holt
Research Associate
Exxon Research and Engineering Company
"Inter-Industry Cooperative Research and the Government"

Prof. Koichi Shimokawa
Visiting Professor, Harvard Business School
(from Hosei University, Japan)
"An Innovation Succeeds: Honda's Entry into the Worldwide Automotive Industry"

Discussants

Mr. Harold C. MacDonald
Vice President, Research and Engineering Staff
Ford Motor Company

Mr. Carl E. Nash
Special Assistant to the Administrator
National Highway Traffic Safety Administration

Friday, October 20

8:00 AM Breakfast/Faculty Club, Kresge Hall

9:00 - 11:30 AM

5.

TOWARD MORE EFFECTIVE REGULATION

Moderator

Prof. D. Quinn Mills
Harvard Business School

Papers

Prof. Robert A. Leone
Harvard Business School
and
Prof. John Jackson
University of Pennsylvania
"Toward More Effective Organization for Public Regulation"

Dr. David S. Potter
Vice President
Environmental Activities Staff
General Motors Corporation
"Improving the Regulatory Process"

Dr. Lawrence J. White
Council of Economic Advisors
"American Automobile Emissions Control Policy -- Success Story or Wrongheaded Regulation?"

Discussants

Mr. Carl E. Nash
Special Assistant to the Administrator
National Highway Traffic Safety Administration

Honorable Dave Stockman
Republican, Michigan

6.

INNOVATION AND REGULATION

Moderator

Mr. Seymour S. Feuer
Group Vice President - McCord Group
Ex-Cell-O Corporation

Papers

Prof. William J. Abernathy
Harvard Business School
"Innovation and the Regulatory Paradox: Toward a Theory of Thin Markets"

Prof. Stephen P. Bradley
Harvard Business School
"A Risk Analysis of Federal Regulation in the Automobile Industry"

Mr. Frank Popovich, Director
Automotive Services Group
Data Resources, Inc.
"Government Regulation and the Future of the Automobile Supply Industry. Where Were We, Where Are We, and Where Will We Be?"

Discussants

Mr. E.S. Brower, President
Automotive Products Division
Allied Chemical Corporation

Dr. Richard L. Strombotne
Director, Office of Automotive Fuel Economy Standards
U.S. Department of Transportation

11:45 - 1:00 PM Lunch/Faculty Club, Kresge Hall
Speaker: Honorable Dave Stockman, Republican, Michigan

1:10 - 3:00 PM McCollum Center

7.

MARKET INCENTIVES AND
THE CONSUMER
PART A
PRODUCT LIABILITY

Moderator

Prof. Douglas Ginsburg
Harvard Law School

Papers

Prof. Daniel M. Kasper
Harvard Business School
"Product Liability: Potential for Improvement"

Dr. Hans-Viggo v. Hulsen
Head Foreign Legal Department
Volkswagenwerk AG
"Product Laibility: Against Possible Disincentives to Innovation Generally and Safety Improvements Specifically

Discussants

Dr. Nicholas A. Ashford
Assistant Director and Associate Prof. of Technology and Policy
Center for Policy Alternatives
Massachusetts Institute of Technology

Mr. Jan W. Rozendaal
Owner/President
Nordic Ford-Toyota-BMW

8.

INTERNATIONAL TRADE
AND THE AUTOMOBILE

Moderator

Prof. Raymond Vernon
Harvard Business School

Papers

Mr. Michael Charles Pearce
Head of Automotive Research
The Economist Intelligence Unit
"International Competition in the World Automotive Industry"

Prof. Mira Wilkins
Department of Economics
Florida International University
"Multinational Automobile Enterprises and Regulation: An Historical Overview"

Prof. Louis T. Wells, Jr.
Harvard Business School
"U.S. Regulation of the Automobile: A Blip in the International Product Lifecycle"

3:00 - 3:15 PM Coffee/McCollum Lounge

3:15 - 5:00 PM McCollum Center

PART B
CONSUMER CHOICES

Moderator

Prof. John R. Meyer
Harvard Business School

INTERNATIONAL TRADE cont.

Discussants

Mr. Robert V. Coleman
Automotive Specialist
Bureau of Domestic Development
U.S. Department of Commerce

Papers

Mr. Michael M. Finkelstein
Acting Associate Administrator for Rulemaking
National Highway Traffic Safety Administration
U.S. Department of Transportation
"Consumer Information, The Auto Purchase Decision and Industrial Innovation"

Mr. Brian Ketcham
Vice President and Chief Engineer
Citizens for Clean Air
"The Role of Consumer and Public Interest Organizations"

Discussants

Mr. Peter Kinzler, Counsel
Consumer Protection and Finance Subcommittee

Mr. Sydney L. Terry
Vice President, Public Responsibility and Consumer Affairs
Chrysler Corporation

Mr. Kenkichi Konishi, Director
Japan Automobile Manufacturers Association

Mr. W.R. Wilkinson
Executive Director, Product Strategy Development
Ford Motor Company

5:10 - 6:00 PM Concluding remarks/Burden Auditorium 20
Honorable Joan Claybrook, Administrator, National Highway Traffic Safety Administration, U.S. Department of Transportation

6:00 - 7:00 PM Cocktails/McCollum Lounge

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change in the industry. Current conditions pose an entirely new challenge to policymakers and managers whether they be in government, labor or business firms for there are few practical analogies or theoretical concepts to guide policymaking in the present market.

The situation abounds with unanswered questions: to what extent can further socially desirable change be successfully encouraged through government regulation, or other direct government policy intervention or incentives? What are the longer run implications of government policies on productivity, international trade,

employment, and competitive vitality? What mix of competitive incentives, government R & D investment, and regulatory action might best be used to encourage the development of useful new technology? What type of government-industry relationship, e.g. cooperative, adversarial or neutral, might encourage more effective performance? Now, after several years of experimentation with new types of government programs it is time to examine and learn from the emerging consequences. This series of meetings was undertaken in such a spirit of inquiry and learning.

The meetings were designed to gather insight and understanding from those who have intimate knowledge about problems and opportunities for improvement, gained through their own direct involvement with this sector. While other programs have previously brought together particular agencies of the government with industry or other organizations to deal with selected problems, a unique objective of this program has been to engage a broader range of participants in a constructive effort to promote progress in a form that is consistent with national needs. Toward this purpose Harvard has sought to provide a structured but neutral forum where participants could offer an informed but individual perspective on important questions. Although progress in seeking common grounds for progress was desired, three more specific objectives were initially envisioned. As stated in a preliminary proposal for the program these three were first, to help develop a fresh perspective and improved definition of major policy questions; second, to clarify different and sometimes conflicting viewpoints, assumptions, and strategic interests of different constituents; and, third, to stimulate inquiry and research within a broader community

on policy issues, as an aid to the formulation of improved policy in the future.

The objectives of the Symposium were generally achieved, as discussed in subsequent sections. As expected, however, the proceedings of meetings involving such diverse participants did not lead to a consensus about future policy action. However, useful progress was realized on several fronts. Substantive issues from which policy disagreements arise have been identified through the Workshop proceedings. These are first summarized and then presented in more complete detail in section II of this report. The planning assumptions and the conduct of the meetings, including comments on the outcome, are discussed in section III. Research papers addressing some of these issues were also presented and discussed by participants at the Symposium; of these, the papers whose preparation was supported through government funding are included as section IV of this report.

To achieve the broadest dissemination of the Symposium results, the separate publication of conference papers and discussion is also being arranged through a major publishing company, McGraw-Hill Book Company. The most intangible but perhaps the most significant product of these series of meetings has been the direct communications and exchange that was achieved. A clearer definition of conflicting positions and interpretations of facts is an essential step toward a constructive resolution of these differences.

SECTION II

KEY POLICY ISSUES

II

KEY POLICY ISSUES

The five Workshops that were held at Harvard from October through April in preparation for the Symposium were designed to assist in identifying key issues whose resolution might contribute to improved policy formulation. The method of choosing topics; the selection of participants who were of diverse backgrounds and well-informed, as well as the choices of both a neutral setting and neutral moderators, were intended to help identify the substantive reasons for disagreement rather than to seek expedient but often more superficial areas of mutual agreement. The major issues that were identified through the Workshop process are subsequently described by session and in the context in which they arose. Five key policy questions, from among the more than thirty issues that are reported, are summarized below. These five questions present what the authors of this report consider to be the important themes underlying a variety of subordinate issues that were raised by participants from different organizations in several Workshop sessions. Each question presents an area where further inquiry could contribute to improved policy formulation. Each raises issues that offer the potential for substantial progress over the longer term rather than an immediate problem.

Five Summary Issues

1. Federal R & D Policy in the Motor Vehicle Sector

   There was a broad consensus among participants that the level of current investment in advanced technology for the future is at a low ebb within the U.S. automotive sector. Recent steps by the West German government to provide more extensive R & D support for their national motor vehicle industry, suggests that

this condition is not a problem unique to the United States.

To date the government's role with respect to R & D appears to have been defined largely through precedents set in a number of disparite contexts, such as military procurement, space exploration, and applied biomedical research. Individually, these would seem to have only secondary implications for government R & D policy in the motor vehicle sector, yet collectively they have set the outer limits of what seems proper to policymakers dependent upon innovation. In fact the federal government has involved itself in motor vehicle R & D to much lesser extent that the outer limits set in other areas of paramount national commitment. Instead, direct product and process regulation has been the almost exclusive instrument of federal policy to promote socially beneficial change in motor vehicles during the last decade.

The issues that were raised in regard to R & D policy concerned the following specific questions.

a) In what areas might federally funded R & D programs or incentives offer a useful and less inflationary alternative to direct regulation in the 1980's, particularly with respect to socially beneficial environmental, safety and fuel conservation technologies?

b) If undertaken, how might such programs be structured to promote the highest rate of competitively based innovation? Also, how should the expertise and viewpoint of innovative groups outside the major government-industry establishments be included in such a program?

c) Should guidelines that currently limit the participation of firms and government agency personnel in the cooperative development of socially beneficial technologies now be reviewed?

d) Which of the proposed or possible changes in patent law and other regimes for the protection of proprietary technology offer the best prospects for encouraging more rapid technological development?

2. Product Rating Information for Consumers a Policy Instrument

The idea that market forces provide the most effective incentive for technological change in a competitive industry is broadly accepted. This would imply that government policy toward automobiles should give high priority to the provision of the information necessary to a well-functioning market. Aside from recent government requirements that fuel consumption data be reported, however, little headway has apparently been made in using product performance information for consumers as an instrument in national transportation policy. It is true that steps have been taken to make motor vehicle accident data more accessible for safety analysis and that the U.S. Department of Transportation is pursuing programs to determine the feasibility of providing consumer information on vehicle safety performance. The Justice Department and the FTC have also been vigorous in their actions to limit misleading information in advertising. There is evidence, however, that the U.S. may be lagging some other industrialized nations in the quality of source data that government statistics provide for dissemination as consumer information. It has been suggested that more extensive consumer information may be a stimulant to European auto firms, causing them to innovate more rapidly for their local markets. Nonetheless, consumer interest groups in the U.S. pursued their goals through the more visible route of direct regulation rather than the more subtle, but perhaps ultimately more promising, avenue of seeking improved consumer information to stimulate technological change through market incentives. (Consumers Union is an exception in this regard, and it is noticeable for its singularity.)

The issue of improved information and market incentives was raised in a number of different contexts throughout the Workshop sessions. Examples include the potential role of insurance-rating data as an incentive in both vehicle purchase and maintenance; and safety performance ("crashworthiness") ratings. The implications were that the full potential of a more directed government policy of providing information on vehicle performance may be large, but that this potential has not as yet been fully realized. The promise is significant, however; inquiry into the potential sources and effects of improved information would certainly seem to be warranted.

3. Information Inputs to Regulatory Decision-Making

The adequacy of the information and analyses available for regulatory decision-making was a recurring issue in the Workshops. Many regulations are only now reaching complete implementation and their full ramifications for various sectors have only recently become apparent, often in unexpected ways. This constituency opposing regulation has visibly broadened and deepened as its second-level effects have emerged.

Some opposition, and some surprise among those secondarily affected may be inevitable, of course. The ramifications of regulation are at best difficult to anticipate initially through cost-benefit analyses, and when information about the true value of the benefits and costs depend upon the groups particularly affected, it is even more complicated.

While it is popular to consider the regulatory process in the automobile industry as an adversarial one involving primarily

the major manufacturers, the government, and perhaps a few consumer interest groups; the relevant constituencies, and the types of costs and benefits involved, extend far beyond these. The Workshop proceedings point up an apparent need to broaden the regulatory decision-making process in order better to identify more of the vital interests at stake. The number and variety of different participants who in some form questioned the thoroughness of analysis that supports regulatory decision-making procedures stand out; this is a major and deep-rooted concern. Some form of disagreement was expressed by participants from organizations ranging from consumer interest groups to automotive suppliers and aftermarket organizations, to government agencies, as well as the major manufacturers, both domestic and foreign.

It may be that the regulatory process is in such basic conflict with vested interest groups that allegations of bias and incompetence cannot be avoided. Notwithstanding this possibility, the Workshop proceedings seem to suggest that a less contentious approach would be desirable. The centrality of this issue is illustrated by the wide range of related issues and proposals that were raised throughout the discussions:

a) A proposal to insure fresh but informed advice from outside the established government-industry circles by funding the research of independent groups.

b) The use of third party review panels was proposed, composed of independent experts to corroborate the validity and scope of evidence supporting the regulatory process.

c) A variety of proposals suggesting additional types of criteria and evidence that should properly be weighed in regulatory decision-making.

d) The suggestion that more thorough and appropriately directed cost benefit analyses should proceed regulation.

e) A proposition that many regulations are now obsolete and represent an impediment to product innovation and that these should be revised or rescinded.

4. Regulation and International Trade

Federal transportation policy and regulation originated in an era and from concepts which could reasonably presume a closed U.S. national production and market system. Increasingly international competitive factors are influencing both U.S. producers and the U.S. market. Contrary to the assertions of some European auto executives, it was apparent from Workshop proceedings that as a practical matter regulatory decisions on environmental and safety issues have been made without regard to international trade considerations as they relate to the automotive industry. Although mechanisms certainly exist for policy coordination, the preparatory analyses necessary to establish strong linkages between domestic regulators and international trade issues do not seem to have been done. As the character of the U.S. automotive industry becomes more international in nature it will be crucial that such policy linkages be more actively pursued. The Workshop identified a number of issues for which policy analyses should be conducted to identify linkages between the U.S. interest in domestic regulation and its interest in international competition.

5. Transportation Policy

Many of the other issues basically relate to the need to establish a more consistent U.S. transportation policy. The U.S.

Department of Transportation and NHTSA within it are charged with a variety of missions which at one time place this one agency in multiple and diverging relationships to the consumer, the industry, and the national economic interest. The Department of Transportation and its subordinate units are called upon to act simultaneously as policeman in an adversary position to the industry, as an agency with a supportive role in matters such as R & D to promote innovation, and as a regulatory agency in other cases, balancing the interests of consumers, the industry, and national economic policy. It is only natural that such conflicting roles introduce uncertainty within the industry, very likely to the detriment of progress toward national goals. A number of issues raised during the Workshops illustrated the need to separate the administration of these responsibilities, if not to resolve possible conflicts internally.

Specific Issues by Workshop Session

Each of the thirty-three issues that arose through the Workshop proceedings are discussed in the subsequent paragraphs. Rather than to abstract these ideas, they are presented to the greatest extend possible in the discussion context within which they arose. The types of organizations from which the participants at these Workshops were drawn are listed in the following Table 2. A complete list of individual participants in both the Workshop and the Symposium is included in Appendix G. In reference to the Workshop issues it should be noted that not all of the topics that were discussed could be included here. In fact, it is not likely that all would agree that these represent the most important ones. The authors have endeavored, however, to include those on which the participants were most broadly and deeply engaged in discussion.

Table 2

Participant Organizations

Major Automobile Producers

- Chrysler Corporation
- FIAT
- Ford Motor Company
- General Motors Corporation
- Toyota Motor Co., Inc.
- Volkswagen A.G.

U.S. Government: Congressional Staff

- Department of Commerce
  - Bureau of Domestic Business Dev.
  - Direct Trade Negotiations & Agreement Division
- Department of Energy
- Department of Transportation
  - Energy Demand Analysis Branch
  - Energy & Environment Division
  - NHTSA
  - TSC
- National Science Foundation
- Office of the President
- Office of Technology Assessment

Suppliers

- Bendix Corporation
- Borg-Warner Corporation
- Budd Company
- Cincinnati Milicron Corporation
- Dana Corporation
- Eaton Corporation
- Ex-Cell-O Corporation
- Federal-Mogul Corporation
- Gleason Works
- Goodyear Tire & Rubber Company
- Hazeltine Company
- ITT
- Kennecott Copper Corporation
- Libbey-Owens-Ford
- McCord Corporation
- National Steel Corporation
- Rockwell International
- A.O. Smith
- Texas Instruments Inc.
- TRW, Inc.

Oil and Energy Organizations

- Exxon Research Corporation
- Gulf Science & Technology Corporation
- Institute of Gas Technology

National Auto Dealer's Association

United Auto Workers

Insurance Industry

- Allstate
- Highway Safety Research Institute
- State Farm

Financial/Legal

- Donovan, Leisure, Newton & Irvine, Counsellors at Law
- Merrill Lynch, Peirce, Fenner & Smith, Incorporated

Advertising Industry

- Grey Advertising

Consumer Groups

- Citizens for Clean Air
- Consumer's Union

Commonwelath of Massachusetts

United Nations Center for Transcontinental Corporations

Academic Institutions

- Babson College
- Florida International University
- Harvard University
- Indiana University
- Massachusetts Institute of Technology
- New York University
- University of Michigan

1. The Regulatory Process

The Workshop on The Regulatory Process was held on October 20th and 21st, 1977. It was chaired by Professor D. Quinn Mills and involved twenty-six participants as identified in Appendix 1. Six major issues from this session are summarized below.

A. Implications of the Move to Smaller Cars

Although there is no real room for doubt that the American automobile industry is going to continue reducing the average size of its product, there was considerable disagreement within the Workshop concerning the implications of this trend for passenger safety and auto repair costs. A participant with knowledge of insurance statistics asserted that data already exist to show that the frequency and severity of insurance claims increases with the proportion of small cars in the insured fleet. If this is indeed the case, then the danger and the expense of automotive transportation, as reflected in insurance rates, will be increasing in the future.

On the other hand, it was asserted by both domestic and foreign automobile manufacturers that, on the basis of European experience, one should not expect the move to smaller cars to cause an increase in insurance claims. These parties interpret the existing data to reflect a transitional situation in which small and large cars are both on the road; accidents between a small and a large car result in greater damage and injury to the passengers of the smaller car, creating the impression that small cars by their nature give rise to greater repair costs and severity of injury.

There is a third view, presently under consideration by some parties within the government, that small cars may raise safety problems that larger cars do not create. This view was not elaborated on at the Workshop.

The question of whether the move to small cars will, in fact, increase the frequency and severity of damage, injury and insurance claims is, in principle, empirically resolvable. Both parties to the dispute claim to speak from empirical data already extant, but apparently the question has not been resolved through analyses of those data. This particular question is important in its own right but at the same time it is illustrative of a larger policy issue — the choice of appropriate policy to reduce uncertainty in technological change that is brought about by regulation.

When rapid technological change in mass produced high volume products is sought through regulatory action, unanticipated side effects seem to be more the rule than the exception. The possible health implications of adopting diesel engines which were discussed may be an example of this. More general use of diesel technology would help to meet fuel economy requirements for 1985, but it is not known whether diesel emissions are carcinogenic. Possible injury hazards from airbag protection systems are cited by critics of this approach as another major source of uncertainty in recent safety regulations. Since small cars are being adopted in response to fuel economy regulation, the safety implications of small cars are, in a very real sense, yet another illustration of the potential uncertainty of regulatory action.

The question is whether different government or industry policies might reduce the risk in actions that must be taken in

the face of these uncertainties. In this regard one participant from a consumer interest group called for a policy of more prototype testing, or small scale, trial adoption, before requirements are placed into effect industrywide. In the case of the small car and its safety implications, would more extensive analysis of the small car's safety characteristics in the European environment have been helpful? It would be hoped that a careful analysis of the safety implications of small cars might clarify this specific question, and perhaps by illustration place the broader issue in perspective.

B. Regulatory Decision Making

One participant from the automotive industry was very strongly of the view that the agencies of the government concerned with automobile regulation act as adversaries to the industry and advocates for a view, rather than as neutral decision makers. This view is not to be understood as denying the necessity for administrative policy making; hard policy choices must be made, and it is understood that they may appropriately be made on what can broadly be called "political" grounds. The objection, rather, is that policy must be made on the basis of neutrally determined technical issues that are severable from the policy questions they precede. The problem perceived is, therefore, an infection of technical analysis by the policy position of the analyst.

The Workshop gave considerable discussion to the proposition that the government's decision making process would be improved if a neutral "third party" were established to resolve technical questions upon unimpeachably neutral grounds. Once resolved,

these technical findings would form the basis for the policy making that must inevitably be done. One government administrator, however, was of the view that the industry's real dispute was with the policy resolutions adverse to it rather than with the manner in which technical decisions are reached.

The proposal, and the dispute from which it arises, is important and not at all frivolous. It is a fact that the automotive industry is regulated by agencies of the executive branch of the government, and not by the "independent" form of regulatory body that has been established to deal with other intensively regulated industries. These independent agencies, such as the FCC, CAB, and NRC are comprised of a decision making body of commissioners who conform to quasi-judicial norms concerning ex parte presentation, the need for written and reasoned decision making, and consistency in adjudication over time. They do make policy, often important policies affecting the whole structures of particular industries, but they do so in a manner substantially independent of either executive branch or congressional pressure. Instead, these branches of the government affect the policy making of the independent agencies respectively through the executive power to nominate their commissioners, and the congressional power to confirm these appointments and appropriate operating budgets. Ultimately, of course, the Congress and the Executive may also combine to amend the statutory mandates of an agency, or to reverse by legislation one of its decisions.

In contrast, the Department of Transportation, the National Highway Traffic Safety Administration within it, and the Environmental Protection Agency, operate as arms of the Executive Branch.

Their administrators are subject to removal by the President if they do not, in his judgement, execute the policies of his Administration. It is probable that there is a greater combination of functions in particular agency personnel than would be practiced within one of the "independent" regulatory agencies. In any event, there is the appearance -- alleged by the industry at least -- that the technical aspects and the policy making functions within these agencies are not being kept separate.

The question of regulatory structure with which this topic is connected, has implications that are much broader and more serious than just the potential for the appearance of bias or error that may be introduced in a particular decision. Recent comparative studies of regulated industries suggest that the overall regulatory structure within which an industry functions would seem to be a decisive factor, influencing long-term technological development, productivity gains, and the expansion of goods and services as well as the way the industry may respond in the short run to changing public or political interests.

C. Government Organization for Regulation

An issue related to, but distinguishable from, the "third party" proposition of the foregoing paragraph is whether the government would be better organized to regulate the automobile industry if it operated through a single automotive regulatory agency -- whether independent or contained within the Executive Branch. The suggestion here is that there are problems created

by the division of authority among differnet agencies, such that the Environmental Protection Agency is concerned with emissions control, the Department of Transportation with automotive safety, and the Congress itself has articulated the specifics of the national plan for increasing mileage per gallon.

Thus, a former government administrator suggested, on the basis of experience with the government's development of a policy concerning miles per gallon, that a coordinating body is needed in order to gather and relate data that are now based in several different places. Furthermore, it is possible that the policy respecting any particular problem -- emissions, safety, or mileage -- will compromise the achievement of one of the other policies. (Example: emissions control techniques may decrease mileage per gallon). It has been suggested in the Workshop that coordination is necessary in order to fully appreciate the cost of imposing one set of regulations on the automobile where to do so compromises the policy expressed in another set of regulations.

Furthermore, beyond the implications that any failure to coordinate may have for policy efficacy, it is possible that the industry is able to exploit the division of authority in such a way as to influence policy making in its favor. If this is so, then it should be counted as a cost of the present diffuse structure of regulation.

We think that it would be useful to have an analysis of the advisability of creating a coordinating body within the government, supplemental to the existing regulatory authorities. Further, whether matters would be improved by the creation of a single,

industry-specific agency within the government should be examined.

We think it would also be a public benefit to pursue further the desirability and implications of direct congressional participation in the regulatory process. Such participation can take two forms. First, the Congress may specify regulation in detailed legislation as it has recently done concerning required mileage per gallon over the next decade or so. Second, the Congress may provide that regulations devised by an executive or independent agency will not become effective until a certain period such as thirty days has elapsed without congressional reversal thereof. The governmental participants in the Workshop variously suggested problems with these types of congressional involvements.

Congressional review of agency regulations deprives the agency decisional process of the usual presumption of finality. It requires that the relevant congressional committee acquire an expertise, if it is to review the regulations, that would normally be appropriate only in the agency itself. This is a consequence also, it would seem, of deep congressional involvement in specific statutory regulation such as that for mileage per gallon. Finally, it has been suggested that some of these decisions may be technical in nature, and that the Congress's involvement necessarily politicizes their resolution. These observations are necessarily very preliminary. We think they should be dealt with in a systematic, thorough, and scholarly fashion.

D. Trade-Offs in Regulatory Objectives

References have already been made to the possibility that the achievement of one policy affecting the automobile may entail

the compromise of another policy with which, for reasons of technology, it conflicts. The example given was that of a possible trade-off between emissions control and mileage per gallon. In a related vein, it was suggested during the Workshop that it might be desirable to permit manufacturers to trade off the achievement of one policy goal in return for their exceeding the minimum required with respect to another. Thus, for example, the manufacturer who has a particularly good technology for gasoline mileage might be excused from full compliance with emission or noise controls. The appeal of this suggestion, of course, it that it enables the government to exploit such specialization in achieving regulatory goals as may occur by reason of competition in the automobile industry. At the same time, it is difficult to imagine how agencies of the government, or anyone for that matter, would go about equating achievements in one field with the offsetting reductions to be allowed in another. In the nature of regulation, as opposed to marketplace transactions, there is no common currency in which to measure, say, an increase of two miles per gallon of gasoline against "X" amount more of noxious fumes. Still, one can imagine a bargaining model for achieving such trade-offs to the net benefit of the government's program and the public's welfare. But the uncertainties and unknowns of this opportunity are myriad. For example, what are the nature and magnitudes of potential benefits: By more rapid technological progress, increased innovations, greater competition, etc.? What is an appropriate conceptual framework for this problem? By what standards should the success or failure of such a program in operation be

measured? How should the regulatory agencies be organized best to accomplish this trade-off policy? These and the other related issues should be explored and evaluated in work that would precede a serious proposal for allowing trade-offs.

E. Performance Standards versus Design Specifications

Product regulations frequently take the form of requirements that a certain design or technology be used. The alternative form is to require that a certain standard of performance be met, with official indifference to the particular design or technology used for achieving it. It is now commonplace among those who have dealt with regulation generically to prefer performance standards in order to allow the participants in the regulated industry to compete on the basis of their efficient achievement of those standards. Design specifications obviously do not leave as much room for competition and it is often asserted that they retard innovation. The negative effect of regional building codes on technological progress in home construction is frequently cited as an example.

An interesting challenge to this conventional wisdom was raised and discussed at some length during the sessions. It begins by viewing regulation as a process, wherein choices that are made initially structure subsequent reactions and even evoke further regulation within the same industry. Over time the decision to regulate may create an environment that requires further regulation, enforcement, etc., leading to a long-term life cycle effect. From this perspective, performance regulations were seen to generate more subsequent regulatory action or enforcement than

design specifications.

It would seem appropriate to explore the debate concerning performance standards versus design specifications in the particular context of the automotive product. A first question may be whether in this context, the debate is really an important one. Insofar as we are talking about regulation for safety, for example, it simply may not be practicable to adopt performance standards. It might not be practical (or politically palatable, that is), to specify an allowable number of deaths or injuries per thousand automobiles manufactured by a particular company. Alternatively, it may indeed be that the best approach to safety improvement is to specify a percentage reduction in the deaths or injuries attributable to a manufacturer, and to impose a fine or tax on deaths or injuries in excess of that level. (The analogy to mileage per gallon regulation, and fines for exceeding the fleet average requirements, is obvious). The role of the tort system for product liability may be understood in part in just this manner; it forces internalization of accident costs, thereby providing an incentive to optimize the safety-accident mix.

If there are significant differences in the effects of these two types of regulation can the form of the difference be identified in a systematic way? Are there important situations in which regulation could take either form? What forms have been used thus far, and what is the argument that each is appropriate to its case? Why, for example, is it thought that mileage per gallon regulation is appropriately handled by performance criteria, while safety requirements are handled by detailed criteria that approach design specification, as for example in requiring padded

dashboards? Is this a function of the availability of present technologies, their importance as competitive factors, or access to information concerning them? We think that the significance of this debate in the automotive context should be traced out to its fullest. The answers to these questions will have implications broader than the automotive context, but they will be particularly useful for future deliberation of automobile regulation.

F. Information Management

Workshop participants from the industry expressed the concern that sensitive information they are required to submit to various regulatory authorities has in some cases subsequently been disclosed to the public and, hence, to their competitors. The potential for even broader disclosure is raised by extensive recent government requests for information and new requests for disclosure under the Freedom of Information Act. Industry participants perceive a fundamental conflict between such disclosure and competition, which is most obvious when the information concerns research and development paths or plans for the introduction of a new product or technology.

On the other hand, the implications of suppressing such information are serious indeed. When proprietary information becomes the basis for a governmental decision, its publication may be necessary if we are not to invite arbitrary decisions, based on secret information, and perhaps even corrupt decisions.

How is the conflict between competition and public lawmaking to be resolved? The problem would seem to be significant, but

poorly defined. The industry, which is most familiar with the problems being experienced due to disclosure, is in the best position to carry forward consideration of this issue. The development of the issue requires a definition of the problem and harms, as well as a reasonable proposal for protecting proprietary information without unduly compromising the public decision making process.

2. Consumer Issues Workshop

The Workshop on Consumer Implications was held on November 17th and 18th, 1977. It was chaired by Ms. Rhoda Karpatkin, Director of the Consumers Union and Professor Walter Salmon of Harvard University and included thirty participants altogether. Eight of the issues which were discussed at the session are enumerated below.

A. Licensure of Auto Repair Shops or Mechanics

At the outset of the Workshop on Consumer Implications of Technological Change in the Automobile Industry, we learned that a few states have recently enacted legislation requiring the registration of auto repair shops or the certification of new automotive mechanics. Related legislation is being considered within the government of the Commonwealth of Massachusetts. Legislation of this sort is aimed at consumer protection from unscrupulous operators, which is potentially to be accomplished in two ways. First, the registration process may be used to screen out individuals with a record of consumer fraud, while mechanics certification excludes the incompetent. Second, the existence of a registration requirement gives the relevant agency significant leverage in

bringing consumer complaints to licensees for correction.

This sort of legislation is also subject to abuse, both in design and in administration. For example, occupational and service industry certification has often been used in the past to restrict competition by limiting entry into the field, facilitating anticompetitive price information exchanges, and prohibiting as "unethical" practices that promote competition (for example, competitive bidding). The insurance industry representative at this Workshop immediately expressed concern because this type of legislation had been introduced in some states with the support of the regulated industry; it was alleged that certain provisions had chilled competition and in one case even prevented an insurance company from requiring the submission of multiple bids in support of a claim for repair work.

The arguments for and against a registration scheme for automotive shops or certification of mechanics should be elaborated for broader public consideration. Legislative developments at the state level often occur without full public awareness or debate; this should not be allowed to happen in the automotive repair case, which importantly affects all of the drivers in each state.

B. Consumer Product Information

For the diligent consumer facing the purchase of an automobile, there is a wealth of information available for the evaluation and comparison of various cars. Much of the comparative information that has been available to the nonprofessional consumer,

however, concerns mechanical design features and the maximum performance capabilities of new vehicles. In recent years more information has been provided the consumer, some as government requirements (such as posted list prices and EPA mileage ratings). The effect of such additional information on purchasing behavior still does not seem to have been evaluated.

One cannot look at the present state of the world with any confidence that the mix of information consumers would value or need is presently the one supplied. Research has apparently been undertaken within the government in order to determine what information is indeed valued by consumers. Thinking along similar lines has undoubtedly been done by the industry and by those consumer organizations that are heavily involved in the provision of information. This research and thinking should be made available in a systematic manner for the benefit of the industry, consumer interest organizations, and perhaps such entrepreneurs who might arise in response to the finding that there are unfilled needs for information.

One specific type of information that might prove valuable to consumers, and toward which inquiries should be directed, is the "crashworthiness" of each automobile model. We were given to understand that at least one European country presently administers automotive testing through a government agency whose crashworthiness ratings are required information on the sticker of every new car. A similar regime was envisioned in the Motor Vehicle Information and Cost Savings Act of 1972, but it still has not been implemented. Special thought should be given to the feasibility and utility of this approach and to its value to consumers.

In particular, this potential approach should be compared with the present system, in which insurance rate information is the best proxy available to the interested consumer.

C. Standardization of Diagnostic Testing

The prospect of serious future difficulty for the consumer in securing adequate repair service was discussed by Workshop participants in some detail. There seemed to be rather general agreement that more extensive use of computer diagnostics in after-market service organizations offered one of the brighter prospects for improving this situation. Access to diagnostic services has the potential to increase the quality of information available to the consumer in purchasing repair services, with prospective consumer benefits related to those discussed in the prior topic. Probably even more important are benefits in the form of more accurate and efficient repair services, and less dependence by the dealer on highly skilled and scarce repair personnel.

A serious potential for degradation in the current level of repair work was seen in the confluence of four trends: 1) increasingly complex automobile technology that will require a higher degree of professional repair work just to maintain the current level of customer service; 2) a decrease in the number of dealers or other service organizations that will be capable of providing the necessary service, because the higher levels of investment that will be required of dealers to cope with advancing technology can be expected to bring about more concentration within the after-market; 3) the specialization that may be required of repair

organizations if different car producers follow increasingly divergent technological options in automobile design to meet tightening regulatory standards; 4) a decrease in the tolerance of future cars to poor maintenance. As automobiles become more complex the absolute chance of malfunction may be decreased, but when malfunctions do occur these automobiles may be less able to "limp along." Consumers may, therefore, be subjected to greater inconvenience and risks when failures do occur.

While the more extensive use of computer diagnostics was discussed as an important step, there may be important barriers to their widespread adoption. It was contended by one participant that the lack of standardization among different car models in the diagnostic function was a major barrier to broad adoption. Since a large investment in diagnostic equipment, training, and organization would be required of service organizations, there could be little incentive to enter the diagnostic field under conditions of rapid change from year to year, especially if the equipment would not be common to different car models. Based on this consideration, the consumer would benefit from increased standardization.

An alternative consideration advanced was that such standardization, coming at a period of rapid technological change, could inhibit innovation in diagnostics at the very time when this opportunity requires further development. The presence of other technical or institutional barriers (e.g., antitrust) was also advanced though not fully developed.

We believe that the issues surrounding computer diagnostics are important. Is standardization or coordination among manufacturers

a prerequisite to the emergence of a diagnostic service approach, and are there other prerequisities? Do antitrust or other considerations bar the development of diagnostics where they are otherwise economically warranted? What government or industry steps, if any, are appropriate to encourage the development of this approach?

D. Insurance Rates and Safety Design

Reference was made earlier to the possibility of providing crashworthiness information to automobile purchasers. At that time it was mentioned that insurance rates are at present one proxy for such information. In the course of the Workshop, one automobile company executive maintained that insurance rates had so much affected the market for a so-called "muscle" car that the company's product line had to be reoriented if it was to maintain its market share. This was asserted as a known, internally accepted fact on which the company based policy. If it is a true fact, it is obviously quite relevant to our understanding of the manner in which consumers presently process information relative to purchasing a car. Do they, that is, look at the life cycle cost of operating the car for a given number of years, rather than looking simply to the initial purchase price? If so, how finely can they make a relative cost judgement in the absence of any centralized source of comparative data? How do insurance rates influence purchasing behavior? Do insurance rates offer a mechanism that could be better used to direct technological change in intended directions, in lieu of regulation?

Empirical research should be produced to document or dispel the assertion that insurance rates have significantly influenced

automobile purchasing decisions and, therefore, automotive design decisions.

In this context, it was suggested that no-fault insurance is significantly more effective as an incentive than traditional insurance, because insurance premiums in a no-fault regime more fully reflect the repair cost consequences of the initial purchase decision. Under no-fault, that is, a car that for reasons of design is, say, fifty percent more likely to be in an accident of a certain type will carry an insurance premium fully reflecting that design differential. Whether this would be less true under a fault or negligence system remains unclear. If the two systems have this differential consequence for insurance rating and, hence, design for safety, it would be an important fact for the consideration of legislators looking either at no-fault insurance or at safety design requirements. Therefore, a comparative analysis of no-fault and negligence schemes, with this potential difference in mind, should be conducted.

E. Implications of the Bumper Standards Case

There emerged at the Workshop a sharply focused disagreement over the impact of the requirement that automobiles be equipped with bumpers capable of withstanding five-mile-per-hour impacts. On the one hand, an insurance industry executive suggested that the standard is ineffective in reducing damage and repair costs by an amount equal to, or exceeding, the cost of complying with the standard, i.e., that the standard is not cost-effective for the consumer. An automobile company executive, on the other hand, maintained that the standard is working as anticipated, and that gains will be more discernable as the fleet is standardized

with crash-worthy bumpers set at an equal height.

Resolution of this issue would be an important contribution to the government's ongoing process of product regulation. Crash-worthy bumpers were required precisely because it was thought that they would be cost-effective, and the requirement would seem easy to abandon if they are not cost-effective. The data necessary to resolve this issue should be available from the insurance industry, and we think that their analysis of the data should be helpful in clarifying the effect of the regulation.

F. Measuring Consumer Satisfaction

There was general agreement within the Workshop that automobile purchase and repair transactions provide the largest percentage of consumer complaints. At the same time, Americans will purchase more than 10 million vehicles again this year, and many will purchase the same make, or another product of the same company, as the car they are replacing. This latter fact indicates positive consumer reaction to the product.

Is the volume of consumer complaints imply a reflection of the importance and pervasiveness of automotive transactions for consumers? Or is it disproportionately high? The measurement of consumer satisfaction is still a very uncertain matter, but academic work has been proceeding for at least a few years in isolated places to develop an index of consumer satisfaction with purchases. The emerging state of this art should be surveyed, and its application to the context of automobile purchases and service transactions should be evaluated.

G. The Dealer's Role in Service

Much discussion and speculation about impending changes in the automotive maintenance and service sector implicitly assumes that this sector is relatively homogeneous. The Workshop discussion suggested, however, that distinctly different segments of the industry should be recognized in order properly to understand the changes that are and will be taking place. It is certainly useful to distinguish at least two segments -- service-only organizations, and dealer organizations that are primarily sales oreinted but maintain a service operation in order to facilitate new car sales. Technological change in automobiles may affect these two types of operations in very different ways. Some potential developments have been referred to before: higher investments may be required by service organizations to acquire more sophisticated repair and diagnostic equipment; the use of "tamper-proof" modules in the automobile may bar do-it-yourself and gasoline station repairs; a greater mechanical sophistication in automotive technology can be expected to require higher skill levels, especially insofar as electronics are brought on board, etc.

We think that a hard and informed look should be taken at the implications of these technological trends for the dealer's service operations, and for systematic changes in industry structure. Will further specialization and investment requirements for services result in severance or a closer relationship between sales and service in a centralized repair/service arrangement with branch service facilities; or greater reliance on factory level repair of modules? Such changes in distribution and service arrangements may be noted in the recent histories of some other industries, such

as consumer appliances, and it may be possible to make relevant comparisons with those industries.

H. The Consumer Movement in the Automotive Context

Many of the foregoing issues are among those that have concerned the organized consumer movement for some time. Yet, our Workshop discussions revealed a rather general concern with the adequacy and efficacy of consumer representation in public policy making to date. It was perceived that the most important instances of consumer interest groups' input to legislative or agency processes have come in repsonse to official action or proposals, rather than at the initiative of the consumer representatives. I.e., the public agenda is not being set by consumer concerns; it arises from other sources, although it may then be sensitive to consumer interests. Second, there may be a general deficiency in the data that consumer representatives can command, both because their resources are limited, and becuase the subjects of automobile regulation are becoming increasingly technical and specialized.

It is an appropriate time, we think, to evaluate the impact that consumer representation has had on the course of automobile regulation, and to analyze the ways in which it might be better organized, utilized, and funded in order to be more effective in the future.

We are not here calling for a general overview of the consumer movement in the United States. Rather, the review should be limited to consumer representation in the process of automobile

regulation. The automobile purchasing and servicing decisions are sufficiently significant to consumers and their welfare as to deserve special concern and analysis. This concern is heightened by our sense, based upon the Workshop, that the subjects of automobile regulation are becoming increasingly technical, and thus threaten to surpass the capacities of present voluntary consumer representatives to participate in decision making.

3. R & D in the U.S. Automobile Industry

This Workshop was held on March 9th and 10th, 1978. It was chaired by Dr. Herbert Fusfeld, Director of Research at Kennecott Copper Corporation, and involved thirty participants from various sectors. Five issues which were discussed are summarized in the following paragraphs.

Although a wide range of issues were raised by participants throughout the session, questions about the federal government's role in automotive research and development programs permeated much of the discussion. Should the government fund or even conduct R & D programs with the intent of advancing automotive technology in the public interest? What are the relevant criteria for selecting particular areas of government R & D investment? If the federal government does fund R & D, how far toward commercialization should it be involved with a given project?

There was no disagreement among participants as to the government's important traditional role in supporting the basic R & D work that underlies the creation of new knowledge and supports inquiry into promising scientific fields. Also accepted without question was the observation that spending on R & D by suppliers and major automobile

firms had increased overall in the last few years both in relative and absolute terms. At the same time participants collectively acknowledged that this investment was out of necessity now more than ever directed toward short-term goals of immediately useful technologies. It was contended by industrial participants that the industry did not have the capital to pursue the mix of longer term advanced programs that had historically been undertaken or that should properly be undertaken to further future transportation needs. Despite this claimed reduction in the level of effort devoted to longer term objectives, there was pointed disagreement over the role that federal R & D support might play to fill in any shortfall in the industry's R & D effort. Furthermore, the disagreement did not divide clearly along government, industry and academic lines.

A. Federal R & D Support for Specific Technologies

The issue of government support for the development of specific technologies was brought into focus through the concrete example of emission control technologies for the diesel engines. The potential of unique health hazards (carcinogenic exhaust) from diesel emissions, if broadly adopted, was discussed in detail. The diesel's attractive fuel economy makes it a particularly interesting engine for passenger cars under tight fuel economy standards. It was contended by a government participant, on the basis of his own survey of industry R & D programs, that little if any work was underway in U.S. industries to develop technologies to reduce harmful diesel emissions. The explanation for this seemed to be that the real health hazards of these emissions to humans are suspected by some but apparently still undefined. The

availability of engine technologies that might replace the diesel or solve any health question that may exist with this engine has yet to be defined. Lacking specific knowledge of a health hazard the industry lacks the incentive to undertake solutions. The problem is embedded in substantial uncertainties, apparently of sufficient magnitude to discourage vigorous private R & D funding.

The proposal offered by one government participant was that the government should fund the development of technologies that would solve the diesel emission problem since the industry has yet to do so. While there was agreement among industry and government participants that government-supported R & D was warranted in this particular case, there were also sharply dissenting views. One participant was of the definite opinion that industry should bear the full liability of any damage to the environment or human health that resulted from any new product that it introduced, such as an automotive diesel. In response it was noted that neither the government nor industry knows as yet whether diesel emissions have the alleged carcinogenic effects in respect to humans; and by the time health problems are defined there may be much greater use of the engine in passenger cars.

This issue brings to the forefront the importance of clearer guidelines for government R & D funding.

B. Cooperative Programs Among the Firms

The potential for technological progress through cooperative research and development programs among industrial firms and with the government was discussed at numerous points in the session.

Several industry participants cited the achievements of past cooperative programs as well as the current need for cooperative effort among different industry sectors (e.g., petroleum and auto manufacturing) in support of this suggestion. Specific reference was made to past achievements of the in er-industry emission control program joining the resources of eleven organizations including Ford, Fiat, Datsun, Mitsubishi, Toyota, Atlantic Richfield, and others. The joint industry government CRC-APRAC program was cited as another example of effective cooperation. In this program the government, automobile manufacturers, suppliers, and the petroleum industry among others joined in cooperative work. In recent years these channels of cooperation have been restricted as relationships among government, industry, and public interest groups became more adversarial. There have followed allegations of collusion through such cooperative programs and the consent decree that the automobile industry subsequently accepted in response. The government's decision to withdraw support for its participation in the CRC-APRAC program in response to similar concerns has reportedly led to a great reduction in its effectiveness although the program has continued. An example of the need for such cooperative work was noted in respect to petroleum fuels where recent innovations in pollution control technologies (such as the three-way catalyst) were reported to have serious ramifications for the petroleum industry's efforts to innovate in developing new catalysts and vice versa.

The call for improved institutional arrangements to encourage cooperative research and development was not endorsed by all participants. One government spokesman contended that with firms as large as Ford and General Motors the need for cooperative research programs was not significant. Are the necessary innovative programs so large that the firms in the industry cannot effectively carry them out? There was no agreement by the participants as to the exact magnitude of the benefits which might accrue from more extensive cooperative programs either between firms or between firms and the government. The discussion, however, did suggest that the magnitude and nature of benefits and potential disadvantages should be more carefully considered. While the advantages and disadvantages from cooperative work cannot be empirically resolved in any absolute sense, a thoughtful approach to the problem could clarify potential benefits, areas of past achievements, and areas of difficulties in order to set the problem in better perspective.

C. Federal Markets as an Incentive for Innovation

The possibility that federal procurement might be used more effectively as an incentive for innovation and technological development within the industry was raised in discussion. Notice was taken that the market created by the Department of Defense for high performance products had been the stimuli for many major innovations of great importance to the country since World War II; the jet engine for commercial aircraft, computers, and semiconductors were noted. The question was raised whether the collective federal expenditures for motor vehicles, components and R & D

might not be applied somewhat more successfully as a tool for stimulating innovation and encouraging commericalization. In response to the suggestion it was noted by several participants that this had been tried, but unsuccessfully. Specific reference is made to Section 212 of the Clean Air Act. Federal purchases of automobiles that might be subject to such procurement specifications were stated to be less than .2 percent of total production, amounting to some 12,000 vehicles a year, in comparison with the 10 million units produced in total. Given the high cost of R & D and tooling for automotive developments, serious questions were raised over the prospects that this level of incentive would have any effect in stimulating innovation. A subsequent government interagency review of the Section 212 provisions led to a recommendation that it had proved ineffective and recommended that its implementation procedures be disbanded. Although this past attempt to use procurement as a tool to stimulate action has not been successful, it must also be noted that the more recent Electric and Hybrid Vehicle legislation still envisions progress through this approach under a program administered by the DOE.

The sharply contrasting history of success and failure with procurement as an incentive for innovation plus the recently demonstrated interest of Congress in legislating procurement incentives calls attention to the need to understand better this mechanism as a stimulus for innovation. In particular, information might be collected regarding the Department of Defense's experience in stimulating innovation through its procurement action relevant to motor vehicle transportation, and successful procurement

incentives in other capital-intensive industries as well as the Electric and Hybrid Vehicle program now underway. It would be a contribution to clarify the controversy, on the basis of past experienced procurement incentives over the potential of the procurement mechanism for stimulating innovative activity.

D. The Appropriateness of Innovation Levels in Automobile Producers

Have federal programs become the initiating force in innovation within the automobile industry, replacing competitive incentives? It was contended by a former government official that the axis of influence as regards important innovations for the future had shifted to Washington, as a result of both regulation and federal R & D, such as DOE's stirling engine, electric car, and turbine programs. This contention was vigorously contested by several industry participants. Five major innovative transformations in the industry during recent times were cited as examples: (1) the change in both the packaging size and the conceptual framework of vehicle design; (2) the change in the process by which a vehciel is designed, specifically in respect to Computer Aided Design; (3) the extensive incorporation of electronics in the logic of power train systems, as a result of (4) the development revolution in power plants; and (5), the rapid and far-reaching application of new materials in many automotive components. It was further contended in response that these changes have not been brought about through government R & D programs. The discussion, while contentious in some respects, does help to identify a basic difference in understanding about the

degree to which government programs may be counted as useful sources of technology as well as regulatory incentives. Given the growing national concern over innovation, it would be instructive to examine the constructive role of federal programs in supporting automotive innovation both in respect to incentives and as sources of useful advanced technology.

E. The Effects of Regulation and Government Action on Innovation

It is not uncommon to read claims that regulation has reduced the level of innovation in U.S. industry. All too often this discussion is vague and does not pinpoint the specific mechanisms and particular aspects of regulation that have adverse of beneficial effects on innovation. Several participants in the Workshop were specific about the effects that regulation might have and, in some cases, improved procedures were suggested. The first of these was referred to as the problem of "bang starts". By this was meant the requirement for rapid introduction of an innovative feature across a broad range of the product line in high volume production. A second was the effect of uncertainty that is induced by regulation. It was contended at least that the "bang starts" substantially increased the risk that the manufacturer faces in innovation. In the past, an innovation would first be introduced in small quantities (usually on higher priced models as an option) tantamount to a pilot test-run. Then adoption would broaden and volumes increase as the performance and cost of production were brought under control. In this way the product was perfected and the risks better managed. In response to this criticism a government participant asked for an example

and questioned whether the current passive restraint requirements were indeed a good example of such a "bang start". There was not a clear enough response to this question to identify how pervasive this asserted problem might be.

The problem of regulatory uncertainty was illustrated in discussion with reference to the 121 standard, the so-called antiskid brake standard. In this case legal challenges based on claimed safety problems with the standard had led to its suspension. One major supplier claimed that his corporation had subsequently decided to cut R & D investment for components that might be intended to meet specific regulatory requirements.

These brief examples suggest the need for a broader base of data from which it might be judged whether these sources of uncertainty indeed present a substantial problem with regulation and whether it might be corrected with administrative procedures in implementation. If uncertainty is particularly troublesome it would be important to identify its origin. For example, is it within the control of one agency or is it perhaps the result of legal action in regard to regulation or other interactions so that no one agency or branch of the government or the industry, alone, can do much to reduce the uncertainty in the regulatory program.

4. The Automobile Supply Industry

The Workshop on Implications of Technological Change for the Automotive Supply Industry was held on April 5th and 6th, 1978. The chairman was Professor Quinn Mills of Harvard University and the

discussions involved thirty-four participants. Eight issues from this session are summarized in the following paragraphs.

A. Effect of Regulation on Supply Firms

Historically, the automotive supply industry has not participated directly in the regulatory process by which safety, pollution, and now fuel conservation standards have been set, even though it produces about one-half the value added to the final product. Instead, the industry, which is made up of a very large number of firms ranging from relatively small to quite large and diversified companies, has felt the impact of regulation through the specifications and design requirements incorporated into the process by which automobile manufacturers have procured components.

At present, some suppliers believe that, because the automobile manufacturers cannot adequately anticipate what government regulations will require in the medium-term future, the manufacturers are pursuing multiple supply alternatives and deferring the choice among them until such time as the technical choices are clearer. The automobile manufacturers represented at the Workshop seemed to concur in this view. Moreover, they say, the result is to increase the risk faced by each individual supplying firm since "there's only going to be one winner" when the final design choice is made on the basis of final regulations.

At the same time, academic and government observers seem to think that the general direction in which regulations would be changing over the future was if anything clearer now than it had ever been in the past. Indeed, in this view, the only open question is the rate at which regulations will change to require ever

greater performance in the safety, pollution and fuel efficiency areas. Accordingly, these parties had anticipated that the required areas of research and development budgeting would if anything be clearer under present circumstances than it had been for some time.

What are the unarticulated premises that account for this difference in these two analyses of the uncertainty that results from regulation? Is it that performance regulations, even when applied with relative certainty, tend to destabilize market conditions for firms supplying the regulated industry? Will these altered conditions change the competitive conditions in which supply firms function? Will this create conditions in which only the larger suppliers can accommodate the risk associated with this market, thereby leading to greater concentration at the supplier level? Might this favor international supply firms? There is a need to better anticipate the consequences of regulation for suppliers as well as primary producers.

B. Vertical Integration and the Changing Role of Suppliers

In a related discussion, it was a matter of common ground between the automobile manufacturers and their suppliers that the supplying firms are becoming ever more involved in the design process. (There was less agreement as to whether this was a function of an accelerated rate of design change in response to regulatory requirements). Interestingly, however, it was an automotive manufacturer's spokesman who observed that under conditions of rapid change suppliers might feel particularly threatened by the possibility of backward integration by the automotive companies. With a shorter time over which to amortize research and

development or product design, that is, the prospect of backward integration represents an even greater threat than otherwise.

A different view was taken by another automotive representative. He suggested that, due to the pressure now being placed on automobile companies to allocate research and development funds toward improving fuel efficiency, further integration of the firm backward into the supply process is quite unlikely. Indeed, it is an empirical observation within his firm, that the degree of vertical integration, measured on a value added basis, had not increased at all in recent years. If anything, it was suggested the trend might be toward disintegration in order to avoid the enormous investments that would be required just as capital is being allocated, as mentioned above, to fuel efficiency undertakings. One supplier spoke in support of this latter point, anticipating an expanded if more demanding role for those supply firms that could provide the needed technology.

It would be helpful, in clarifying the impact of regulation in this regard, to have detailed information on the vertical effect of regulation on integration for the industry as a whole, for each of the last several years. More particularly, breakdowns within the self-supplied sector of the automobile might reveal the direction in which even a constant rate of integration is skewed. It was suggested by one automobile manufacturer, for instance, that plastics suppliers are particularly concerned about integration into their domain. Is there any empirical basis for this concern? Why, precisely, are these component or material suppliers more likely, in their view, to be displaced by the automobile companies than are other suppliers? In general, what is

the likely direction of change in the degree and composition of vertical integration within the industry? The role of supply firms seems to be changing vis-a-vis the major automobile producers, but will this lead to stronger, more independent suppliers as in Europe or greater vertical integration by the major automobile producers?

C. Step versus Increments in Regulatory Requirements

There was general agreement among the participants in the Workshop that regulation has, in general, shortened the life of the typical automotive component. An exception to this general observation must be made for body styles which, under the impact of regulation, are being changed less frequently than used to be the case. A participant from one of the major automobile companies questioned the social utility of regulatory standards that are applied for as short a period as one year at a time, with a higher standard set for each successive year when the regulations are initially promulgated. The tooling and supply costs associated with such frequent changes, it was suggested, may exceed the expected benefits of gradually accelerated increases in a standard.

As one economist noted, most any economist would have thought that an incremental approach in regulation was always better than a single large step change of equal total magnitude applied over the same period. Yet, it was intuitively plausible on the basis of the concern raised in the previous paragraph that incrementalism might not be socially efficient in this circumstance, namely where each increment occasions a significant capital cost. At this point, all that can be said is that the situation is quite unclear.

It is clear enough that regulators, schooled in traditional economics, have tended to favor gradualism by setting annual or biannual standards. What, in fact, would be the optimal duration for the life of a regulatory standard?

D. <u>Regulations as Incentives for Innovation by Suppliers</u>

At least one participant from a supply firm at the Workshop has adopted a policy to avoid making any research investment in developing products mandated by government regulations. This particular firm had previously made investments in airbag and other developments, only to find that the products involved would not in fact be required on the schedule they had anticipated in allocating funds. There was more general recognition that a decision to develop and manufacture mandated products involves a certain degree of political risk--since regulations may be revised or deleted, that is--not associated with the development and manufacture of products for which the demand is market-driven. The latter sort of products tend to experience more gradual fluctuations in demand as public tastes evolve.

At present, there does not seem to be any hard information on the number of firms that have had an adverse experience with investments in products they expected to be required on the automobile. Beyond this, there is no good information on the number of firms that have made a policy decision to withdraw from mandated markets. Some measure of these phenomena would be informative. For example, does such uncertainty tend to reduce significantly the number of market participants, such that markets for mandated products are less competitive than others? Certainly there are some costs associated with regulatory uncertainty, as

there are with any uncertainty; the question is how significant this cost might currently be, and whether there are ways in which to minimize it consistent with the achievement of those policies represented by the regulatory efforts.

E. Performance versus Design Standards

In previous sessions, we have already heard debate over whether performance standards are inherently superior to design specification standards, on the grounds that performance standards allow manufacturers greater flexibility to innovate competitively in meeting the standard. Nonetheless, it was noted at this session that at least certain supply industry firms seem to be more comfortable with regulations specifying particular designs, perhaps because this type of regulation provides more certainty for R & D investments. As one supply firm representative put it, design specification "is not necessarily restrictive of freedom on our parts." With performance standards, on the other hand, supplier firms are "forced to adopt a less active role in research and innovation and capital and become more passive and responsive" to the technological path ultimately chosen by the automobile manufacturers. Alternatively stated, performance standards open up many options to an automobile manufacturer, but a broader range of options than any one supplier can follow out by allocating research and development monies to each; design standards, on the other hand, enable those supplier firms positioned to supply the required component to concentrate on competing among themselves as to how best and most cheaply to meet the standards.

This view of the impact of design versus performance standards was by no means universally shared. One supplying firm was clearly of the view that performance standards enable new firms with new ideas to penetrate supply markets for the first time.

It is sufficiently clear from our discussion of this point that a unitary answer cannot be given regarding the impacts on competition of performance versus design standards. Some firms apparently gain, while others lose, depending upon how the choice is made. Moreover, the rate of technological change is most likely affected by this decision as well. A more precise formulation of the issues at stake in the design versus performance debate is still wanting. We see here an opportunity to inform that debate through an empirical study of the competitive consequences that have actually ensued from various design versus performance standard decisions that the government has made. Finally, it will be important to distinguish between the impacts felt at the automobile manufacturing level and those felt at the supply sector level. These may be quite different, as the Workshop discussion indicated.

F. Capacity Constraints Facing the Machine Tool Industry

Representatives of the machine tool industry cast great doubt during our discussion on that industry's ability to provide sufficient capacity to meet the 1985 standards (27 1/2 miles per gallon) for fuel efficiency. The machine tool industry is already, we are told, receiving inquiries from automotive manufacturers concerning the availability of capacity through 1982.

According to the machine tool representatives, the industry's capacity problem is a function not of a shortage of investment

capital but rather of trained manpower. According to their analysis, the cyclical nature of machine tool orders and profitability have been a persistent obstacle over the years to the successful sponsorship of an industry training program. As a result, the incumbent work force is aging and is not being adequately replaced by younger entrants.

Insofar as the timely achievement of government policies may depend upon the availability of adequate machine tool manpower, the government should appropriately be concerned to determine for itself the facts concerning future industry capacity. The facts concerning industry capacity and manpower should be determined so that an orderly consideration of all potentially relevant policies may be conducted.

G. Proposed Improvement in Rulemaking

A participant from the National HMghway Traffic Safety Administration suggested that the government's approach to rulemaking for automobile regulation may have been unnecessarily rigid in the past, in that an agency would typically determine first what it thought the best regulatory course to be, propose a regulation embodying that course, and then ask for comment on the advantages and disadvantages of that single proposal. NHTSA will, on the other hand, now be approaching regulation by convening rulemaking proceedings at an earlier stage in its thinking, proposing an entire range of options for comment without commitment to any one option in advance. The agency's hope and expectation seems to be that by changing its processes in this manner it will elicit a wider range of relevant information from the affected parties,

including suppliers who have tended to limit their participation in rulemaking proceedings in the past.

In fact, another participant from the government noted that the supply industries tend not to deal with the government in any organized or focused way, as for example through a trade association with its own staff of experts. And a supplier acknowledged that his firm tends to rely on the automobile manufacturers to alert them to relevant rulemaking proposals, since even a relatively large supplier cannot maintain its own Washington staff for this purpose.

As one observer pointed out, this pattern of supply industry reticence and reliance on the automobile manufacturers seems particularly anomalous in light of the potential political influence that an organized supply sector could exert; there are an estimated 25,000 supply sector firms and they are distributed much more evenly among the political districts of the country than are the automotive manufacturers alone.

What are the reasons for which the supply sector has historically limited its direct involvement with the regulatory process? Why is there no strong trade association representation of the supply sector before the government? Do the supply firms take their cue, in maintaining a low profile, from the automobile companies themselves and, if so, why?

We are aware of no prior analysis of this field of political activity specific to the automotive sector. Nor are we convinced that the supply industry's generally low level of participation in the regulatory process is atypical, particularly for the early

stages of government involvement in a product regulation. If the automotive supply industry is atypical, however, the reasons for its unusual stance deserve exploration. In the absence of such an analysis, it is particularly difficult to evaluate the likelihood that NHTSA will succeed, by adjusting its regulatory procedures, in eliciting significant supply industry participation in the formulation of its regulations.

H. Federal Support for R & D

The question of appropriate criteria for federal R & D support, raised in the earlier session on R & D, was visited again in the supply industry Workshop, but with more specific reference to the supply sector. Should the government participate to a greater extent in encouraging and funding research and development into technologies for pollution control, fuel economy, and enhanced automotive safety? Certain supplier representatives objected with particular vehemence to the proposition that the government might appropriately play some role in underwriting such research and development. They pointed to practical problems that arise when a firm that has accepted government aid attempts to assert proprietary rights over information and innovations that were arguably stimulated by the government's participation. Moreover it was argued, there is a fundamental problem of fairness where the government sponsors product development rather than basic research. Government-aided product development, it was claimed, puts competing firms at a relative disadvantage compared to the firm receiving development aid and tends to move the arena of competition to the government funding stage. Basic research,

on the other hand, aids each participating firm in the industry equally, it was said. Thus, suppliers saw the government's R & D role as being appropriately limited to basic research of the sort that individual firms could not afford to undertake, either because of its scale or presumably because the benefits would not be privately appropriable, for example by patent.

At the same time, it was acknowledged that some research and development may be inimical to the interests of the firms best positioned to undertake it. If, for example, there is no market demand for the fruits of a certain type of research, such as pollution control technology, there is no reason to expect that industry will undertake the effort without government-provided incentives. If the R & D is to be done at all, that is, it will be because the government has undertaken to bring it about.

In practice, however, how is the government to determine whether a particular research and development effort required for the achievement of some national policy will be undertaken to an efficient level by private industry? How is it to know, for example, that the automobile industry's current commitment to fuel conservation research is at the socially optimal level? As applied to such topics as automotive safety, where the industry may perceive "improvements" in safety performance as contrary to its own interest, the question is even more vexing. The government clearly needs to develop its thinking in this regard so that it can isolate with some confidence those areas calling for R & D sponsorship.

5. International Issues in the Automobile Industry

The Workshop on International Implications of Technological Change in the U.S. Automobile Industry was held on April 26th and 27th, 1978. Professor Robert Stobaugh of Harvard University chaired the session and thirty-two participants were involved altogether. The eight issues discussed below were raised during the session.

A. Regulations as a Trade Barrier

Are United States regulations for automobile safety, pollution control, and fuel efficiency non-tariff barriers to trade? In general discussion of trade and trade policy, detailed regulations enacted at the national level are frequently cited as non-tariff barriers because they are peculiar to one country and effectively fragment ostensibly international markets into their national components, notwithstanding the absence of an explicit tariff on the movement of goods. It has been suggested in the Workshop, however, that the U.S. automotive regulations with the greatest impact on the product, those concerning fuel conservation, may not be non-tariff barriers in the usual sense. Specifically, the suggestion is that by requiring fuel efficient cars, with consequent down-sizing in order to meet the regulations, the impact of the regulations is effectively to put the United States <u>into</u> the worldwide automotive market for smaller cars for the first time. Foreign makers of small cars are better able to penetrate the domestic market (so the theory goes) because U.S. makers have been unable to compete with their traditional, larger less fuel efficient cars that offer more options and luxury. Indeed, if this effect is operating, the result may be more than merely

neutral; it may be to <u>invite</u> importation of foreign cars by giving them an advantage as domestic manufacturers face increased capital costs in order to adapt their production to the new regulations while overseas manufacturers are able to meet fuel specifications without special adaptation costs. On the other hand, if the U.S. regulations in totality do require significant adaptation by overseas manufacturers, they may have some effect as non-tariff barriers. Indeed, foreign automotive interests have reportedly claimed that regulation has been intended to favor U.S. firms. Which effect dominates? This is an empirical question, but it is doubtful that it can be answered empirically rather than theoretically.

B. <u>Internationalization of Regulatory Standards</u>

Insofar as U.S. automotive regulations do sever the U.S. market from the world market, are there opportunities for increasing international competition by lowering regulatory trade barriers through cooperation to establish international standards? The European Community is reported to be presently engaged in coordination among its members on just this subject. Whether the United States (and Japan) could be folded into this coordinating effort might depend as much upon whether the E.C. is using a different approach in setting regulatory standards as upon whether it is simply setting different standards along the same criteria that are used in the United States. For example, control over a particular pollutant by the setting of a maximum permissible level of emission, where different levels are set in different trade zones, may represent less of a barrier for manufacturers'

international trade than would two differing approaches to control of the same pollutant, such as the required use of a catalytic converter in one country and the required use of an entirely different process or device in the other. It is an open question as to what steps the United States can and should take in an effort to homogenize its approach and standards with those of its major trading partners and vice versa. Relatedly, depending upon one's views of the matter, the answer to the questions put in the paragraph above may control the degree to which one regards coordination as a desirable trade benefit rather than an undesirable loss of further market shared to overseas producers.

C. The Impact of Fuel Economy Regulation on Trade

Has domestic regulation in the interest of fuel economy given an advantage to importers? This question is obviously related to the first one posed by this Workshop, but it can be addressed independently. The suggestion here is that domestic regulation required of domestic manufacturers requires precisely those attributes presently found only among foreign manufacturers, namely the ability to manufacture, and market, a lightweight fuel efficient automobile. On the other hand, the fleet averaging approach taken in the law requiring greater fuel economy was apparently designed to enable domestic manufacturers to offer a range of automobiles, including heavier and less fuel efficient cars, so as not significantly to disadvantage the domestic industry. What is the actual impact of this approach on domestic versus foreign competitors?

D. Interagency Coordination of Domestic Regulation

Observers from within the government have complained that the United States' domestic policies with respect to automobile regulation are formulated without adequate regard to the impacts of those policies upon U.S. trade in automobiles (both import and export). Although coordinating mechanisms do exist, several participants from agencies concerned with foreign trade expressed the opinion that full consideration was not achieved under present procedures. At the same time, it is not entirely clear that further coordination to include trade-related agencies is worth the costs such inclusion would impose in terms of the agencies presently participating. Specifically, there may be no consensus as to how trade effects should be taken into account in the domestic policy making process respecting automobiles. If even significant trade effects are not going to be allowed to have a major impact on domestic policy, then coordination with trade-related agencies would impose costs and provide no benefits. If a more global view of U.S. interests is taken into account in the formulation of domestic policy, then trade impacts may be quite relevant. At present it appears that the domestic policy agencies do not give significant attention to the trade impacts of their decisions. It would seem at least that the major trading partners of the U.S. give much more attention to the foreign trade aspects of their domestic policy. At least some members of the trade-oriented agencies believe that they are being overlooked rather than consciously excluded.

E. Prospects for the Need of Future Government Support

It would be particularly instructive to examine the functional behavior of present coordinating mechanisms to determine the extent to which they actually influence policy formulation. Is the United States automotive industry in a position unhappily analogous to that of the U.S. steel industry? Both industries, it has been suggested, own an aging physical plant, while they face competition from European and Japanese manufacturers operating with significantly newer physical facilities. Inherent differences in productivity due to age of physical plant may be further exaggerated by the fact that overseas manufacturers are growing, that is adding new plants which can be designed to incorporate regulatory requirements and the most productive captial, while domestic facilities must be adapted at increased capital cost per unit. Both the automotive and steel industries in the United States are very large employers concentrated in the industrial states of the Midwest. Both seem to be plagued not only with the competitive disadvantage just referred to, but also with an unfavorable wage rate differential compared to their overseas competitors, and possible government subsidies to these competitors, and, consequently, both now are potential demanders of special treatment and support from the U.S. government. Both industries also appear to suffer from a worldwide capacity glut that is being stimulated by the policies of producing countries to secure employment and the means of security in the event of hostilities. Does the analogy hold? If so, what are the policy implications for automobiles, based upon what we can observe developing already in steel or other industries domestically?

F. Implications of Excess Worldwide Automotive Manufacturing Capacity

Is there excess automotive manufacturing capacity in the world? It was suggested by one international observer that less developed countries are drawn toward investment in automotive capacity in part because automobiles are a glamorous industry for such LDCs, can save them significant amounts of hard currency payments for imported vehicles, and can even earn them hard currencies should they be able to export automobiles. The industry is also seen as a medium for the transfer of production technology and manufacturing skills to the LDC, and a source of large scale employment. Whatever the reasons, however, the point is that world capacity is now much in excess of world demand for output. If this observation is correct, the implications for pricing over the next several years (until demands should grow) may be significant. Specifically, manufacturers may be driven to pricing at or below marginal cost, at least in those countries where state trading authorities or other government policies require continued exports even if subsidies are required for that purpose. Subsidized exports to the United States market would seriously imperil the present domestic manufacturers' ability to subsist without governmental aid, and would undoubtedly draw their attention to the use of governmental barriers toward subsidized competition. Since countervailing duties set by the United States in order to offset foreign government subsidies are difficult to put in place, and not necessarily effective when established, the domestic industry could rightfully be concerned about the hypothesis of overcapacity.

G. Factors Explaining Trends in International Competition

What explains the growth of imports in the U.S. market over the last fifteen years? Has the U.S. industry lost its command of the U.S. market because of steps taken by foreign governments to encourage exports into that market? Is it rather the industry's fault for having failed to respond to customer preferences? For having failed to respond now to governmental programs requiring significant research and development, for example for down-sizing? Alternatively, is this trend the normal result of the "International Product Life Cycle?" If so, why did direct imports increase so rapidly in concert with the onset of tightening product regulation? Finally, is the government "responsible" by the imposition of regulatory standards that were ill suited to domestic industry response capacity, relative to the response capacity of the overseas industry? Settling upon an understanding of the reasons for the trend toward greater importation of automobiles is important to the direction of the U.S. policy response. Does the recent minor upsurge in direct exports to Europe possibly represent the beginning of a reversal in this Life Cycle? Depending upon one's diagnosis of the situation, that is, one's prescription will take different directions. Policy choices respecting possible adjustment assistance to the domestic industry, the imposition of tariffs, or the decision for the government to do nothing, should reflect the government's understanding of the origins of the problems that the industry faces.

H. Prospective Changes in International Competition

What are the problems likely to affect international trade in automobiles in the future? In the near term, if foreign automobile companies make significant production investments in the United States, what will the United States' reaction be? As the U.S. market for automobiles continues to shrink relative to the world market, will this restrict domestic policy freedom by making it more difficult for regulators to influence the design of foreign cars for purposes of standard setting? Will multinationalization of automotive unions follow in the wake of transnationalization of production? Will the transfer of automotive technology to LDCs continue, and if so, will that have implications for the domestic market in automobiles and possibly other related lines? Is it likely that more extensive regional agreements among smaller countries will emerge in order to assemble large enough protected market areas to support production in the affected countries? If so, will the world market facing U.S. and European and Japanese manufacturers actually shrink through Balkanization? These are the sorts of questions likely to arise upon even cursory speculation about the future problems on the international automotive agenda. Clearly what is needed is more than cursory speculation and projection, in order to put the United States in a position of forethought when the future arrives.

SECTION III

PLANNING, CONDUCT, AND RESULTS

III

PLANNING, CONDUCT AND RESULTS

The planning and conduct of the Workshops and Symposium presented unique problems because of the highly charged and sensitive nature of the political, social and economic environment in which the automobile sector functions. The purpose of this section is to outline some of the planning considerations on which the conduct of these sessions was based, as possible assistance to those planning any future meetings of a similar nature.

The conduct of meetings that propose to address major policy issue must recognize several unique aspects of the automotive environment. A few of the major assumptions on which the present meetings were predicated are as follows:

1. The focus of decision making and the control of innovation is multisectoral. In the current environment no single group such as a government agency or top management of the major automobile producers holds sway over the resources that affect change. A wide variety of different organizations and interests from different sectors shape both policy and change. Powerful influence is now exerted by: organized labor, insurance companies, and government agencies (including, but not limited to, the U.S. Department of Transportation), consumer interest groups, suppliers, congressional organizations, and foreign manufacturers, in addition to the U.S. producers and U.S. market forces.

2. Policy positions tend to be both strongly centralized and to permeate many aspects of operations within each different interest group. There are few issues to

be discussed that do not have ramifications for policy position taken by these respective organizations. This means that policy issues are seldom separable from technical questions and vi e versa. The implications are that a very broad base of expertise is required in discussions.

3. Interests are segmented. Each group will have limited involvement or interest in respect to the full range of issues that actually shape policy.

4. Policy positions tend to be fixed in the short run. The policy positions that each respective interest group assumes are shaped by beliefs, economic interests, and social cosiderations that have deep roots. Although these positions are changing at a relatively rapid rate at any point in time, they appear to be a fixed constraint on problem resolution at any one time and in respect to any one issue.

Given these assumptions, it was considered important initially to have the support of several constituent groups. Consequently, an interest in participating was sought from labor leaders and the major U.S. automobile manufacturers at approximately the executive vice presidential level of authority before a commitment to hold the meetings was made with the U.S. Department of Transportation. It was initially thought that three types of activity would be required successfully to conduct the meetings as they were conceived, in addition to overall planning and coordination: Conduct of the initial Workshops, Conduct of the Symposium, and Research support for

the Workshops and the Symposium. An initial proposal for the meetings is included as Appendix B. Subsequent to the Workshops, the U.S. Department of Transportation also provided funding for a fourth activity: Support for research in preparing papers for the Symposium.

The Workshops were planned as informal sessions that would address the vital interests that different pairs of groups held in common. As an example, the first Workshop, on the Regulatory Process, was conceived as a session where proceedings would center on the interests of the major automobile producers and the regulatory arms of the government, including both administrative and congressional organizations. Similarly the other sessions focused on issues at the intersection of other pairs of interest groups. Quite logically participants from the major automotive manufacturers and the U.S. Department of Transportation were involved in all sessions.

Issues for discussion were elicited from participants in advance of each Workshop. These issues were then collated and became the basis of a more detailed agenda for discussion during the meeting. As an example of this procedure, the set of collated issues and agenda for the April 6th Workshop on the Supply Industry is included as Appendix C. In addition, as a supporting activity a background paper was prepared for most sessions. This paper was intended as a review of major issues as reported in current trade articles and newspapers concerning the topic of the Workshop. Appendix D contains the background paper that was prepared for the same April meeting.

From the proceedings of this Workshop the issues were developed in respect to each of the five topics reported above in

section II of this report. In accordance with prior agreements that comments would not be attributed to individuals or specific organizations in these sessions, these issue statements make no reference to particular spokespersons.

The Symposium was conceived as a first step in addressing issues that were raised in the Workshop sessions. Workshop participants who were strongly interested in particular topics that arose in their session were invited to develop a more complete analysis of that problem. Most of the papers presented at the Symposium originated in this way, although others were invited on selected topics. Because many of the participants held positions in their organizations that demanded much of their time, only about one third of the invitations to prepare and present papers were finally accepted. To encourage as broad an involvement as possible by busy participants, Harvard offered the services of library research assistants to those that wrote papers. The U.S. Department of Transportation provided the Harvard Business School with financial support to compensate academicians and/or participants from non-profit research organizations. Papers written on this basis were:

Individual and Organization	Paper and Subject
Professor Robert Leone, Harvard Univ. and Professor John Jackson, University of Pennsylvania	Toward More Effective Organization for Public Regulation
Mr. Michael C. Pearce, Economist Intelligence Unit, London	International Competition in the World Automotive Industry
Professor Mira Wilkins, Florida International University	Multinational Automobile Enterprises and Regulation: An Historical Overview

Individual and Organization, cont.	Paper and Subject, cont.
Mr. Brian Ketcham, Citizens for Clean Air and Mr. Stan Pinkwas, Citizens for Clean Air	The Role of Consumer and Public Interest Organizations.
Dr. Lawrence J. White, New York University	American Automobile Regulation -- Success Story or Wrongheaded Regulation?

The full list of papers presented was previously presented in Exhibit 1. All moderators, discussants and participants are listed in Appendix G.

The results of the Workshops and the public Symposium cannot be measured on any objective scale but they are judged to be quite favorable. Almost all the planning objectives were well met and there are many indications of positive results. The failure to achieve the significant involvement of organized labor is considered to be the major shortcoming.

A brief questionnaire was administered at the conclusion of each of the last four Workshops in an effort to obtain some systematic information about their conduct. While this did provide evidence about how well the sessions were received, it suggested very little about how they might be improved. A summary of evaluations for three of the questions asked is shown in Table 3. Although questionnaire results were also tabulated by session, by question, and by category of participant, little variation is apparent in these respects. The questionnaire is included as Appendix E. While these results are surprisingly "positive," some caution in interpretation is in order because of possible bias. Despite repeated requests, only about one half of the participants completed the questionnaires, and

it may be that the least satisfied participants did not complete them.

The success of the final Symposium is suggested in part by the public attention it received. Some fifteen articles on the Symposium were subsequently published in journals and major newpapers. As an example of the coverage, one article is enclosed as Appendix F. The full proceedings are also being published separately as a book by McGraw Hill. It may well be that the most important long run consequences will be realized through this medium. It is the judgment of the authors of this report that the most important long run result will be realized from the program's success in extending the knowledge and in broadening the group that is informed about the major issues in this industry. In this regard we consider the program to have been unexpectedly successful.

Table 3

Participant's Response to the Workshop Evaluation Questionnaire

(Percent by Category from 54 Respondents)

1. Did the (workshop) program equal, exceed or fall short of the expectation you had prior to attending the program?

	Industry	Government	Other	Total
Exceeded	30	44	27	33
Equalled	59	38	55	52
Fell short	7	6	18	9
Don't know	4	12	0	6
% in Category	50	30	20	100

2. Was the subject matter (in the Workshop attended) useful to you?

	Industry	Government	Other	Total
Yes	96	87	91	92
Somewhat	4	13	0	6
No	0	0	9	2

3. Was the program about the right length?

	Industry	Government	Other	Total
Too short	41	31	36	37
Yes, about right	55	69	55	59
Too long	4	0	0	2
No	0	0	9	2

SECTION IV

PRESENTED SYMPOSIUM PAPERS

IV

PRESENTED SYMPOSIUM PAPERS

This section includes 8 papers prepared for the Symposium with support from the U.S. Department of Transportation.

CONSUMER SAFETY INFORMATION AS A GOVERNMENT POLICY TOOL

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The government's traditional approach in dealing with health and safety matters has been to impose requirements on an industry via regulation. The National Motor Vehicle and Traffic Safety Act of 1966, for example, provides for government intervention in the marketplace through the establishment of minimum levels of safety performance as stated in federal motor vehicle safety standards promulgated by the National Highway Traffic Safety Administration (NHTSA). A producer must meet each safety standard in order to sell a motor vehicle in the United States.

Title II of the Motor Vehicle Information and Cost Savings Act calls for government intervention of a very different type. This Act authorized NHTSA to rate the comparative performance of automobiles with respect to crashworthiness, damageability, and ease of maintenance, and to provide information on each of these factors to the public. But the government would only provide the consumer with safety information; it would not impose any requirements on manufacturers to change their products.

An examination of the consumer information program authorized by the Cost Savings Act should start with the Vehicle Safety Act, which preceded the Cost Savings Act by six years. The 1966 legislation requiring the issuance of motor vehicle safety performance standards was a political reaction to an increasing number of traffic deaths and a belief that the motor vehicle industry was all but ignoring safety. In part, the manufacturers' posture was said to be predicated on their belief that "safety doesn't sell cars." If this assertion is correct, then of what use is safety information

to consumers and what influence can such information have on their auto purchase decision? A useful point of departure for this discussion, then, is to re-examine the oft-cited, but untested proverbial wisdom that safety doesn't sell.

In extensive studies[1] conducted since enactment of the Cost Savings Act, consumers say that they are concerned about vehicle safety. One important reason for buying a large car is their belief that it is safer than a small car. The studies go on to state, however, that the vast majority of consumers assume that all cars within a size class are equally safe. At the same time, a recent survey done by Peter Hart for the Department of Transportation[2] found that the public's understanding of technological alternatives that can improve safety was surprisingly deep and that the public's desire for additional information was strong.

To date, the public has had little access to information about differences among cars. Obviously, an industry is never anxious to advertise the fact that its products can fail. It is much more desirable to focus on the utility of cars, the pleasure associated with their use, and the status associated with the owner of such a solid product. In spite of this, Ford was advertising itself as the safety manufacturer in the late 1950s, promoting seat belts as options.[3] Volvo[4] and Mercedes[5] still try to sell safety to the motoring public. And as recently as the September 24, 1978 NFL telecast of the Washington Redskins and New York Jets, GM was using films of simulated crashes in their commercials.

In all likelihood, the entry of the federal government into the safety regulation of automobiles in the 1960s led the public to believe that cars were thereby made uniformly safe. While complaining about the cost of

federal regulation, the automobile manufacturers certainly try to give the impression that this same regulation also serves as a governmental seal of approval. The public is becoming increasingly aware, however, that federal safety standards establish minimum requirements that manufacturers can and, in some cases, do exceed. Recent Mercedes ads[6] have clearly shown that safety measures beyond those required by government standards are now being built into their cars.

It is time for the government to make such points as strongly. With Title II of the Cost Savings Act the government has the authority to inform the public that some cars perform better than others, as well as to dispel the notion that all cars within a class are equally safe. Title II authorizes the Secretary of Transportation to determine the relative crashworthiness of automobiles and to communicate this information to the public to aid them in their decision to purchase an automobile. Crashworthiness is intended to measure the relative likelihood of a vehicle occupant being killed or severely injured in a crash. The statute requires that the information be made available in a simple and readily understandable form to ease consumer comparisons.

But the statute was enacted in 1972. Where, then, is the rating system today, six years later?

Congressman Bob Eckhardt, Chairman of the Consumer Subcommittee of the House Committee on Interstate and Foreign Commerce - the committee that wrote the Cost Savings Act - asked Joan Claybrook precisely this question in May 1977, less than one month[7] after she assumed the position of NHTSA Administrator. Claybrook testified that the program had been terminated. After spending almost $3 million, it had been determined that predictive crashworthiness ratings for new cars were beyond the state of the art. Since NHTSA was unable to predict the crashworthiness of vehicles, the program had been abandoned.

Claybrook committed the agency to begin where previous work left off and develop comparative crashworthiness ratings based upon the performance of recent model cars. In part, this recognized that there are twice as many used car transactions as new car sales each year. This policy was aimed as much at the automobile industry as the consumer, however. The increasing number of citizens who are concerned about the safety of the automobiles they drive should have access to reliable information about the track record of the manufacturers. Companies having a record of producing safer cars should be able to benefit from it.

What will happen when consumers have adequate information to conclude that not all cars within a given class are equally crashworthy? We have had several natural "experiments" that may help us answer the question. With the summer of the Pinto and the Firestone 500 behind us, we may now see how consumers responded to two widely publicized defect investigations. Another case worth reviewing, one in which NHTSA had a very minor role, is the Consumer Union's assertion that the Chrysler Corporation's Omni/Horizon was unacceptable because of poor handling.

Ford Pintos built between 1971 and 1976 were found to have fuel tanks designed so that in rear-end collisions the likelihood of fire was significantly higher than for other cars. Subsequent to the 1976 model, under a much stricter federal standard, the performance of Ford Pintos was no longer much worse than their class. However, the finding that fuel tanks on over 1 1/2 million 1971-76 cars in use were unsafe was the basis for requiring Ford to recall these vehicles and to remedy the situation. While this investigation was underway, a California jury awarded $125 million in punitive damages to the young survivor of a Pinto crash who received burns over 90% of his body.

The judge later reduced the award to \$3.5 million, but the initial judgment, combined with the potential cost of the recall to Ford and the spectacular nature of fire accidents, put this issue onto the front page of most newspapers.

While, as mentioned, the 1978 Pintos were materially better than the 1976 version, during the month of the recall (June), Ford could hardly give them away. Even with a \$325 incentive to dealers to sell Pintos, there was a 40% drop in June sales, followed by a 34% decline in July and a 5% fall in August. By the beginning of September, Ford had a 78-day supply of unsold Pintos, compared to Chevrolet's 46 days for the Chevette.[9] Although not yet reflected in the retail values, used Pinto wholesale prices were down 25-40%.[10]

The Firestone 500 case is another instance where a major product line of a major manufacturer was found by NHTSA to be unsafe. Firestone 500s were the top-of-the-line passenger car tire manufactured by Firestone Tire and Rubber Co. until they were phased out of production and replaced by the Firestone 721 beginning in 1977. (However, some 500s were still being manufactured in January 1978.) NHTSA received reports indicating that a disproportionate number of Firestone 500s were failing in use, causing serious crashes in many instances. An investigation was opened and an initial determination was made on July 7, 1978, that a safety-related defect existed in the Firestone 500.

Three factors made the Firestone 500 case a story for the front pages. First was the potential size of the recall, reaching possibly 15,000,000 tires with an estimated cost to Firestone of \$500 million. Second, were Congressional hearings on the subject, chaired by Congressman Moss, and NHTSA

public hearings, chaired by Administrator Claybrook. Third, the combative attitude adopted by Firestone made the issue much more newsworthy. It should be noted that, again, the defective product was no longer being produced; in this case, even the name had been changed. As with the Pinto, however, Firestone passenger car tire sales dropped during the year ending October 31, 1978.

The last case mentioned was Consumer Union's "unacceptable" rating for the Omni/Horizon. This was announced at a press conference June 14, 1978, that received national publicity. Officials of both the U.S. and the Canadian governments tested the car and found no handling problems. While the impact on Chrysler sales was not as pronounced as the impact of the Pinto recall on Ford sales, it was noticeable. The June sales for the Omni/Horizon totaled 15,991, dipping to 14,808 in July. By August, sales figures were up to 19,442, although they fell to 15,837 in September. At the start of September, Chrysler had a 78 1/2 day supply of unsold Horizons and an 82 1/2 day supply of Omnis.[11]

In early September 1977, Chrysler experienced a similar sales loss following widespread publicity about possible Aspen/Volare defects. August 1977 Aspen/Volare sales totaled 47,608; overall, Chrysler sold 105,584 cars during that month. By September the Aspen/Volare sales were down to 39,975 and the overall car sales were 92,633. The October sales figures did show improvement, however, with 49,585 Aspen/Volares being sold; total sales for Chrysler were 113,508 for that month.

While it is not apparent from the foregoing discussion that safety sells, a good argument can be mounted that a perceived lack of safety costs sales. Moreover, when faced with serious safety hazards, the industry is unsure of what to do to offset their effect on sales. In the case of the Pinto, Ford reverted to its mid-1950s approach and advertised the safety features in the 1978 Pinto fuel tanks. While not acknowledging the defects in the 1971-76 models, they did refer to the new improved fuel tank in the 1978s. Firestone, on the other hand, ignored the issue of the 500, but began offering an unheard of two-year warranty on the 721 that replaced it. Further, Firestone was going to spend an unspecified sum to hire Jimmy Stewart the movie star as the spokesman for their company to project an image of corporate integrity. Finally, Chrysler went so far as to publish the Canadian government's positive findings with respect to the handling quality of the Omni/ Horizon.

The point of this examination is clear. When consumers have what they believe to be safety-related information that allows them to differentiate among products, they act on it. Moreover, manufacturers respond to this consumer behavior in their advertising.

The purpose of the U.S. Government in disseminating consumer information is to have consumers react in the marketplace to safety differences and to encourage companies to respond to the consumers' desire for safety by upgrading products. We realize that providing complicated, technical information to consumers about the crashworthiness of an automobile is a difficult task. Although we believe that consumers react to questions of safety, most of the cases where a shift of buying can be observed result from straightforward, negative publicity. Can consumer information based on qualitative ratings of the relative crashworthiness of a car create the same reaction as

well-publicized, life-threatening situations? This is a question that we hope to answer in the course of our development of an automotive ratings program.

Obviously, the presentation and the availability of the ratings are going to be important in gaining consumer acceptance. A brochure which states that the chances of crash survival are 25% greater in car A than in car B when involved in a head-on collision, when wearing a seat belt, when sitting in the rear left seat, and when the occupant is between the ages of 30 to 50, will be meaningless. The data must be presented in a form that is easily understood, yet is not so simplified as to be meaningless or misleading. In addition, we know from previous consumer surveys and in-depth group interviews that people are interested in knowing how the information was developed and specifically what the magnitudes of differences are among automobiles. We also know from testing promotional messages in the previous work that the information should be stated directly and that gimmicks will not effectively "sell" crashworthiness ratings.

In terms of the data and methodologies available, we are better able to provide relative ratings: car A is "better than average," and car B is "worse than average." Will consumers accept "better than average," "average," "worse than average" as a rating scheme for crashworthiness? National Analysts[12] told us in 1974 that "average" is meaningless and that the most acceptable form of crashworthiness ratings was a probability score - the probability of sustaining a fatal or serious injury. So we have here another question that must be examined before an elaborate rating scheme is developed.

The measurement and understanding of consumer attitudes is central to the development of crashworthiness ratings under Title II. We plan to generate the rating data while further exploring the attitudes of the potential

users. We plan to conduct surveys and group interviews as we examine and refine the data necessary for the ratings. We anticipate that we will be able to develop meaningful comparisons of recent car performance and ultimately predict the crashworthiness of new cars. What would we then expect to happen? How does this program mesh with NHTSA's other regulatory activities? And lastly, how does a consumer information program relate to the subject of industrial innovation?

We view the consumer information program authorized by Title II of the Cost Savings Act with an open mind. It is clear that consumers react to information that indicates that a product poses a serious safety hazard. We are hoping to see similar consumer reactions to more positive crashworthiness ratings. We hope that consumers gravitate to safer models and that manufacturers of models rated less safe see a decline in sales.

Over time, if these shifts in sales occur, we would expect that manufacturers would react to the market and exploit crashworthiness. For this to happen, the government must develop valid ratings, ratings in which the consumer can believe.

The more that we in the government can keep this information before the public, the more market pressure the industry will feel to develop innovative safety improvements. For unlike most of our regulations, which are directed at a very specific safety problem or a well-defined component of a vehicle, crashworthiness ratings are all-encompassing. Thus, the manufacturers will have almost complete freedom with respect to improving the crashworthiness of the products they manufacture. With a measurable objective, a profit incentive, and almost total freedom of approach, it is hard to imagine a more fertile environment for innovation.

Finally, a crashworthiness rating program which deals with the overall performance of the vehicle and which, at least in theory, rewards manufacturers who excel, would appear to complement a safety-promoting regulatory scheme that sets minimum performance requirements in very narrowly defined areas. Currently, we are concerned that the present regulatory scheme inhibits innovation and pushes the design of vehicles toward the lowest common denominator, which is in many cases the federal standard. A 30-mile-per-hour rear crash test to assure the integrity of fuel systems may really insure that cars will not exceed the standard but will be designed only to meet that test.

Generalized crashworthiness ratings at their best should invigorate the industry and get their competitive juices flowing in an area that will provide real value to the consumer.

Over the next few years, this will be an area worth watching. The federal government must develop a meaningful rating system and only then will the consumer be able to bring to bear positive pressure on the industry to improve safety.

Footnotes

1. National Analysts (a division of Booz-Allen), "Consumer Reaction to Title II Interpretations," Final Phase I Report - The Automobile Consumer Information Study, Appendix D, 1975.

2. Peter Hart Associates, A Survey of Private Citizens to Obtain Information on Passive Restraint Systems, 1978.

3. Ford ad, Saturday Evening Post, 1956.

4. Volvo ad, Car and Driver, September 1977, p. 36.

5. Mercedes ad, "Germany Special Supplement," Allegheny Airlines Flightline Magazine, October 1978.

6. Mercedes ad, Business Week, September 11, 1978, pp. 106-107.

7. "Motor Vehicle and Cost Savings Act of 1972 - Oversight Hearings," Subcommittee on Consumer Protection and Finance, Committee on Interstate and Foreign Committee, U.S. House of Representatives, 95th Congress, 1st Session, May 2 and 9, 1977.

8. National Analysts, "Consumer Reaction," Appendix D(13).

9. Jenny L. King and Paul Lienert, "Pinto is Big Problem as Ford Shoots for '79 Sales Increase," Automotive News, September 18, 1978, p. 2.

10. Jenny L. King, "Used Pinto Prices Go Pfft; Sales Still Dry Up," Automotive News, September 25, 1978, p. 62.

11. Jenny L. King and Paul Lienert, "Pinto is Big Problem," p. 58.

12. National Analysts, "Consumer Reaction," Appendix D(19).

MANDATED FUEL ECONOMY STANDARDS AS A STRATEGY FOR IMPROVING MOTOR VEHICLE FUEL ECONOMY

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The purpose of this paper is to review the legislative and administrative history of the mandatory fuel economy standards, and to assess the potential of such standards for achieving further improvements in new car fleet fuel economy. On the basis of our review of developments to date, we conclude that if further progress is to be achieved by the mandatory fuel economy approach, the standard will have to be supplemented by related policies to encourage research into and development of new technologies and to mitigate the economic dislocations that will attend further efficiency-seeking changes in the automobile industry.

Automobile Legislation: An Overview

The history of the mandatory motor vehicle fuel economy standards legislation is closely related to the earlier legislative development of mandatory motor vehicle safety and emission standards (see Table 1). It is therefore instructive to understand the similarities and the differences among these three regimes.

Table 1

Motor Vehicle Regulatory Standards Governing Legislation

Product Regulatory Standard	Governing Legislation	Political Environment
SAFETY	National Highway Traffic Safety Act of 1966	Ralph Nader's Unsafe at Any Speed (1966)
EXHAUST EMISSIONS	Clean Air Act of 1970	Strong Public Environmental Movement (1970)
FUEL ECONOMY	Energy Policy and Conservation Act of 1975	Aftermath (1975) of Oil Embargo

Safety Legislation

Motor vehicle occupant safety had become a public issue by the end of the 1940s, but the concerns and potential regulations then focused on the driver. The rising death toll in the 1960s and the publication in 1965 of Ralph Nader's Unsafe At Any Speed dramatically sharpened public scrutiny of vehicle design as a major causative factor in motor vehicle safety. In response to rising public pressure, Congress passed the National Highway Traffic Safety Act of 1966,[1] which established a set of national motor vehicle safety objectives and required that the Executive Branch promulgate appropriate standards to achieve these objectives. Because no specific or easily quantifiable goals were prescribed in the initial legislation, it was difficult to administer. Subsequent motor vehicle emissions and fuel economy legislation on the other hand, has been much more specific in intent and more rigorous in its expression.

Environmental Legislation

In 1965, the Congress passed legislation requiring that motor vehicle emission control standards be promulgated by the Executive Branch, giving appropriate consideration to "technical feasibility and economic costs."[2] As with safety legislation, early emission control legislation contemplated that the Executive Branch would both develop the standards and administer them. The Clean Air Act Amendments of 1970 represented a dramatic change from this approach. Congress itself dictated the standards in the Clean Air Act Amendments. In arriving at the 1970 standards - 90 percent reduction of CO, HC, and NO_x by 1975-1976 - the Congress paid minimal attention to technological feasibility and economic effects.

As the Safety Act was, in part, a legislative response to Nader's book, the Clean Air Act Amendments of 1970 were, in part, a response to the spirit of that time. During the first six months of 1970, legislation had been prepared in the Congress to ban the internal combustion engine,[3] the Administration had proposed a research effort to develop a nonpolluting engine by 1975; and editorializing on the Muskie Committee hearings that led to the 1970 Amendments, the New York Times concluded, "A nation that can put a man on the moon in less than ten years can clean up its engines in half that time."[4]

Fuel Economy Legislation

The first Congressional debates on motor vehicle fuel economy legislation occurred in 1973 in response to numerous reports of a forthcoming energy crisis, a cold winter, early summer gasoline shortages, and the October Arab oil embargo. Since that time, over one hundred congressional bills have been introduced on the subject of improving motor vehicle fuel economy (see Table 2). The bills have covered a

Table 2

Congressional Bills To Improve Motor Vehicle Fuel Economy 1973 to 1977

Nature of Proposed Legislation	Number of Legislative Initiatives 1973	1974	1975	1976	1977
A. Consumer Economic Incentives					
Auto Gas Guzzler Tax	16	6	36		2
Gasoline Tax	2	4	13		
Gasoline Rationing		3	4	1	1
B. Information; Fuel Economy Labeling	2	2	1		
C. Product Regulation					
Mandated Fuel Economy	8	2	15		9
Relax Emissions/Safety Standards	14	14	19		1
D. Motor Vehicle R/D	11	5	19	4	11

wide range of public policy alternatives, including gasoline and motor vehicle taxes, improving consumer fuel economy information, mandated fuel economy standards, and mandatory fuel economy labels.

Of the many proposed pieces of legislation, only three were enacted, and none of those uses the price mechanism to give consumers or producers an incentive to act in desired ways. Two of the new laws pertain to federally funded motor vehicle research and development. In 1975, Congress passed the Energy Reorganization Act (PL 93-438), providing for research and development of advanced automotive propulsion systems; in 1976, the Electric and Hybrid Vehicle Research, Development, and Demonstration Act (PL 94-413) was passed, providing research into electric vehicle technology. Both these laws directed the expenditure of federal funding for long-term automotive research and development in areas to which industry would be hesitant to apply major resources because of the long pay-back periods. The third law, mandating fuel economy performance was passed in December 1975 as part of the Energy Policy and Conservation Act (PL 94-163). The fuel economy standards reflected the same strategy that Congress used in the Clean Air Act Amendments of 1970: Congress dictated a precise goal - 27.5 miles per gallon by 1985 - and the Executive Branch was directed to achieve the standards.

Thus, after almost three years of debate, the Congress chose federally funded motor vehicle research and development and mandatory product regulations rather than the price mechanism (i.e., through gasoline taxes or a gas guzzler tax), as the public policy to attain improved motor

vehicle fuel economy; federal actions have been primarily aimed at improving the fuel economy of the new car fleet rather than on modifying consumer behavior. Although the gasoline tax was viewed as a potentially powerful means for reducing petroleum consumption, it was also viewed in Congress as a regressive tax that would be unpopular with voters.

This preference for product regulation over tax or other price-oriented approaches was not unanimous. Perhaps predictably, the major domestic automobile manufacturers had strongly opposed enactment of mandatory fuel economy standards. For example, Henry Duncombe, Chief Economist at General Motors, testified against imposing "regulation in an area where competition clearly can do a better job," and Fred Secrest, Executive Vice President of Operations at Ford, argued likewise for reliance upon "market forces - which allow manufacturers the flexibility to respond to consumer demand through innovation spurred by competition - rather than arbitrary standards that would tend to limit flexibility and might well deter innovation and improvement."[5]

In October 1974, the New York Times reported that Federal Energy Administrator, John Sawhill, was forced to resign in 1974 because of policy differences with the Administration. He publicly advocated a gasoline tax.[6] The basic policy of the Ford Administration toward motor vehicle fuel economy improvement had been to establish a voluntary program with the industry.

In the National Energy Plan, presented to the Congress by President Carter on April 20, 1977, a "gas guzzler" tax and rebate were proposed on the grounds that present mandatory fuel economy standards were

insufficient to assure needed petroleum conservation. A graduated excise tax would be imposed on new automobiles and light trucks whose fuel economy failed to meet the applicable fuel economy standard under existing law. The proposed gas guzzler tax and rebate are still being debated in the Congress.[7]

Finally, Charles Schultze, current head of the Council of Economic Advisers explained in his 1976 Harvard Godkin Lectures, why public regulation of the private sector is inherently difficult and how it might be made more effective.[8] His main thesis was that regulatory laws have attempted to force people and businesses directly to do certain things rather than to encourage them through more indirect methods. He suggested, as an alternative, the increased use of market-like incentives, such as tax and transfer arrangements, that would enlist private interests in the pursuit of public goals.

Thus, the debate on the efficacy of price mechanisms versus product regulation for improving fuel economy continues. Mandatory fuel economy standards are now the law, however, and, unless and until changed, must be observed.

Standard Setting in the Three Regimes Compared[9]

As we have seen, in each of the three major motor vehicle policy areas - fuel economy, emission control, and safety - the Congress has selected product standards rather than taxes or some sort of monetary incentive scheme as its major policy instrument. A comparison of assigned responsibilities and the structure of the motor vehicle regulatory standards (see Tables 3 and 4) shows that the nature of the product standards is quite different for each of the three areas, however.

Table 3

Comparison of Assigned Executive and Congressional Responsibilities in Federal Regulations for Fuel Economy, Safety, and Emissions

In the Case of Safety (National Traffic and Safety Act, 1966):

- Congress gave the Executive Branch authority to set performance standards with the constraint that they be "practical."
- Burden of proof on agency.
- NHTSA prescribed performance goals which are subject to public hearings and can be contested by all "concerned" parties.

In the Case of Emissions (Clean Air Act of 1970):

- Congress mandated numerical emission goals (e.g., NO_x = 0.41 gm/mile).
- Congressionally mandated numerical goal can legally be contested only on constitutional grounds.

In the Case of Fuel Economy (Energy Policy and Conservation Act 1975):

- Legislation combines strategies of legislatively prescribed and agency prescribed performance goals.

Table 4

Structure of Motor Vehicle Regulatory Standards

Standard	Characteristics	Comments
SAFETY	Equipment Performance	1. Little flexibility to manufacturer. 2. No motive to provide innovative technology.
EMISSIONS	Vehicle Performance	1. No particular equipment required by regulation. 2. Near-term technical fix.
FUEL ECONOMY	Fleet Performance	1. Allows flexibility to manufacturer. 2. Final new car fleet average fuel economy is a function of consumer behavior.

Safety

In the initial regulation of the motor vehicle, the National Traffic and Motor Vehicle Safety Act of 1966, Congress gave the Executive Branch the authority to set practical safety performance standards and goals. The burden of proof as to what was "practical" was on the Executive Branch. The Highway Traffic Safety Administration was to prescribe practical performance goals, which were to be promulgated within the constraints of the federal Administrative Procedures Act. Under the Administrative Procedures Act, proposed administrative standards are subject to interagency and public comment, and can be challenged on a variety of grounds, including inflationary and environmental effects.[10] In contrast, a numerical goal mandated by Congress can only be contested legally on constitutional grounds.

The Safety Act required that automotive safety standards be performance standards; however, because formulating a single motor vehicle safety performance standard was so difficult, the administering agency (i.e., NHTSA), defined performance standards for specific items of motor vehicle equipment such as headlights, side structure, and so forth. These standards are therefore referred to as equipment performance standards. The manufacturer must improve the specified equipment on each vehicle to the mandated minimum performance level. Little flexibility is allowed. In order to attain higher levels of safety, new standards must be added, but the burden of proof that these new standards are warranted rests with the administrating agency. The manufacturer has no incentive to use innovative technology beyond the requirements called for by the agency except insofar as it might reduce cost or minimize consumer discomfort.

Emissions

In the Clean Air Act Amendments of 1970 and the Energy Policy and Conservation Act of 1975, the Congress set numerical values for emission and fuel economy performance goals, assuming what had been an Executive Branch function. A key motivating factor in this procedural change was the Congress's and the public's growing displeasure with the unresponsiveness of the industry to national goals.[11]

The Clean Air Act Amendments of 1970 set numerical limits, on a specified timetable, for each of three major pollutants emitted by the automobile: carbon monoxide, hydrocarbons, and nitrogen oxides. The standards were to be met by each vehicle produced, and all vehicles produced in a given year were to meet the same standard. The legislation did not require any particular equipment; the legislation only required that the standards be met. The role of the administering agency, in this case the Environmental Protection Agency, was to enforce the standards; the burden of proof was on the manufacturer to show that the emission standards had been or could not be met.

The emission control standards have encouraged the industry to develop near-term technical fixes that could be implemented within the time constraints of the standards. The technology that is adopted may not, however, be the most effective overall; e.g., early emission control technology resulted in a significant fuel economy penalty. The legislatively mandated motor vehicle performance standards, in general, do offer more flexibility than the administratively mandated safety equipment performance standards in that they can be gradually tightened, thus giving the manufacturer an incentive to develop new technology.

Fuel Economy

Finally, the Energy Policy and Conservation Act of 1975 combines performance standards mandated by Congress and performance goals prescribed by an agency. The mandatory fuel economy portion of the Energy Policy and Conservation Act prescribes passenger car fuel economy standards for model years 1978, 1979, 1980, and 1985, and directs the Secretary of Transportation to set passenger car fuel economy standards for model years 1981 through 1984, as well as for light trucks and vans. Consideration must be given to: (1) technical feasibility; (2) economic practicability; (3) the effect of other standards; and (4) the need to conserve energy. The passenger car fuel standards were set by Congress at 18 miles per gallon for model year 1978, 19 miles for 1979, 20 miles for 1980, and 27.5 miles for 1985.

The new car fleet fuel economy performance standards are, from the manufacturer's viewpoint, the most flexible since they allow the manufacturer to phase-in new technology development over different motor vehicle lines. The ability to phase-in new technology is particularly important in consideration of both technical and market risks.

History of the Fuel Economy Program[12]

Background

During the early 1970s, studies and programs were undertaken by the Executive Branch on the subject of improved motor vehicle economy (see Appendix 1), which affected the form and administration of the mandatory fuel economy standards. Non-mandatory fuel economy programs complemented ongoing congressional debates on mandatory fuel economy standards.

In June 1971, the Office of the Secretary in the Department of Transportation completed an internal study of opportunities for transportation energy conservation.[13] The motor vehicle fleet was the most promising target. During 1972, an interagency task force consisting of participants from the Department of Transportation (DOT), the Environmental Protection Agency (EPA), the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD) prepared a summary, Energy Research and Development Goals, for the White House Office of Science and Technology. The Transportation Panel of this task force concluded that motor vehicle fuel economy could be significantly improved by 1980 with no major changes in vehicle functional characteristics.[14] These findings were confirmed in the 1974 DOT/EPA Report to Congress on the Potential for Motor Vehicle Fuel Economy Improvement. The DOT/EPA Report to Congress had been congressionally mandated as part of the Energy Supply and Conservation Act of 1974, which required that DOT and EPA assess the feasibility of a 20 percent improvement in new car fuel economy by 1980. The report concluded that rather than 20 percent, a 40-60 percent improvement could be obtained by 1980. These findings became a critical technical input for President Ford's Voluntary Fuel Economy Program and for the mandatory program subsequently enacted by Congress.[15]

Influenced in part by the DOT/EPA study, President Ford announced to Congress in October 1974 a goal of 40 percent improvement in new car fuel economy by 1980.[16] In his State of the Union Message in January 1975, President Ford indicated industry agreement to a Voluntary Fuel Economy Program. The voluntary program was in effect from January 1974 to April 1976, when the Mandatory Fuel Economy Program replaced it. The final

report on the Voluntary Fuel Economy Program (April 1976) concluded that industry product programs then in progress would meet the planned target of 40 percent improvement by 1980.

In March 1975 the White House Energy Resources Council, chaired by Secratary Rogers Morton, requested that DOT establish an interagency task force to study long-range goals for the motor vehicle fleet that would be compatible with national environmental, safety, and economic objectives. The final report from this study, Report by the Federal Task Force on Motor Vehicle Goals Beyond 1980, was issued in November 1976, and concluded that a goal of 100% improvement in motor vehicle fuel economy by 1985, compared to model year 1973, was achievable. This finding was compatible with the goal of 27.5 miles per gallon adopted in the Mandatory Fuel Economy Program.

It is clear from the congressional hearing records on mandatory fuel economy standards, that Congress had little faith in the efficacy of any voluntary program.[17] Mandatory fuel economy legislation did pass as part of the Energy Policy and Conservation Act (PL 94-163) in December 1975. This formally killed the voluntary program.

The mandated fuel economy numbers were based, in part, on projections made in the DOT/EPA study. Heywood, et al., argue, however, that the 1985 fuel economy standards set by Congress were arbitrarily "chosen principally for their symbolic value - a doubling of the economy of existing new cars."[18] Available evidence suggests that this was not the case. At least five years of agency and congressional background work had been performed prior to passage of the mandatory fuel economy legislation. The available data were the best available.

Rule-Making Process

The Energy Policy and Conservation Act (EPCA), Public Law 94-163, enacted December 25, 1975, amends the Motor Vehicle Information and Cost Savings Act to include a new Title V, "Improving Automotive Efficiency." This Title required the Secretary of Transportation to define and implement a program for improving the fuel economy of new automobiles in the United States market. On June 22, 1976 the authority to administer the program was delegated by the Secretary of Transportation to the Administrator of NHTSA.

NHTSA's responsibilities under the Act can be divided into four major areas: (1) to establish and enforce motor vehicle fuel economy standards; (2) to grant exemptions from applicable standards; (3) to review and assess reports from the automobile manufacturers; and (4) to report to Congress on the fuel economy program. In the process of fuel economy rule-making, the NHTSA follows the pattern required by the Administrative Procedure Act;[19] other federal agencies, industry, interested groups, and private citizens are requested, through the Federal Register, to comment on the fuel economy proposals. From these comments, and other available data, NHTSA acquires information that will contribute to the final rules.[20]

In support of the fuel economy rule-making process, NHTSA has an ongoing research and analysis program which is, in part, carried out by DOT's Transportation Systems Center, under the direction of the NHTSA Associate Administrator for R/D, Office of Passenger Vehicle Systems. The objectives of this program are to develop, maintain, and update the data base and analytical tools necessary for rule-making and policy formulation

activities in the area of automotive energy conservation.[21] The philosophy and goal of the rule-making process are to maximize information gathering by interaction with all affected and interested parties.

<u>Passenger Car Rule-Making</u>

Under the provisions of the Energy Policy and Conservation Act, the Secretary of Transportation (authority has subsequently been delegated to the Administrator of NHTSA) was required to develop fuel economy standards for 1981 to 1984 model year passenger cars and for light trucks (under 8500 pounds gross vehicle weight). The major actions undertaken by NHTSA on the standards for the 1981 to 1984 passenger car and the 1980 and 1981 light truck are summarized in Appendix 2. An advanced notice of the rule-making on the 1981 through 1984 standards was issued in September 1976; the formal notice of rule-making was published in February 1977; and the final rule was published in the Federal Register in June 1977.

The sequence of rule-making actions in the 1980-1981 light truck standards followed those on the 1981 through 1984 passenger cars. A questionnaire was issued in March 1977 requesting information from truck manufacturers to help in the standard-setting process: this questionnaire took the place of the advance notice of rule-making. The formal notice of rule-making was issued in December 1977, and the final rule was published in the Federal Register in March 1979. Thus, the two separate rule-making activities each required about 12 months to complete. Both involved significant interaction among the administering agency (NHTSA), the public, and the automotive industry.

Eleven groups participated in the 1981-1984 passenger car hearings, held in March 1977. Five were automobile manufacturers and

four were "funded" public interest groups (Citizens for Clean Air, Inc., Public Interest Economics Foundation, Environmental Defense Fund, and Public Interest Campaign). These hearings represented the first application by the Secretary of Transportation of a new program to fund public interest groups that might otherwise be unable to participate.

The industry in general expressed concern with the financial, marketing, and to a lesser extent technical risks associated with the proposed standards. For example, Henry Duncombe of General Motors testified:

> Technical feasibility is not the key issue here today - cars on the market already exceed 27.5 mpg. The major uncertainty will be the potential losses of auto sales caused by fuel economy standards. It seems safe to say that the more rapidly the fuel economy standards are raised, and the higher the 1985 standards, the greater the risk will be if there is a decline in the rate of replacement of the existing fleet.[22]

The four "funded" public interest groups had different interests. A consultant for Citizens for Clean Air, testified:

> The particles in the diesel exhaust contain several known or suspected carcinogens. Dieselization (to improve fuel economy) will trade the carbon monoxide problem which we know in our cities for a particulate problem which we do not know. We find it hard to believe that EPA will long allow such an engine to emit carcinogenic materials without improving controls.[23]

(Because of uncertainty about potential health effects, the final rule-making decisions on both passenger cars and light trucks assumed negligible diesel penetrations.) Walter Adams of the Public Interest Foundation indicated concern about the lack of competition and innovation in the automobile industry:

> Since World War II American automobile manufacturers, particularly the "Big Three," have had a record of innovative lethargy and unprogressive sluggishness. They have lagged, not led, in the battle to develop cleaner, safer, and more fuel efficient cars. The Government should adhere to its (proposed) fuel economy standards so that the industry will then proceed to do that which it has previously demonstrated it is capable of doing when faced with a national crisis and national challenge.[24]

Other public interest groups presented statements on the health, safety, and consumer impacts of the standards. In the light truck hearings, concern was also expressed about the potential industrial employment impact of the proposed standards.

Following the hearings and subsequent submissions, the final rule was published in June 1977. The proposed and final fuel economy standards are compared in Table 5. (The notice of proposed rule-making, issued in February 1977, indicated a possible range rather than a single value of fuel economy.) The values in the final rule tended to be on the high side of the original projections.

Table 5

Passenger Automobile Fuel Economy Standards, 1981-1984

Proposed in Nature of Proposed Rule-Making (mpg)		Final Standards (mpg)
1981	21.5-22.5	22
1982	22.5-23.5	24
1983	23.5-25.0	26
1984	24.5-26.5	27

Two weeks later, at the July 1977 Senate Commerce Committee hearings on automobile fuel economy, the Big Four automobile makers testified that they would meet the fuel economy requirements of the law, i.e., the new 1981-1984 passenger car fuel economy standards.[25]

In March, however, representatives of the industry had said they could not meet the proposed standards. Elliot Estes, President of the General Motors Corporation, explained the industry dilemma:

> In dealing with the government - and in raising questions and explaining the possible difficulties and costs, we have reinforced the negative image that many people have of us - I don't know how it can be avoided.
>
> In all honesty, we have contributed to this lack of credibility because we wanted to see some promising results with real hardware before we predicted our ability to make progress to meeting some of these standards and rules.
>
> Early last year (1976) we were saying that we didn't know how to meet the 27.5 miles per gallon fuel economy average for 1985 except by building 92% Chevettes. That was the case at the

> time, and, in saying so, I didn't mean that we were not working to do better. Now we are going to take the risk that we can meet the required fuel economy average in the 1980s and still provide a reasonable mix of attractive vehicles that will meet most of our consumers' transportation needs.[26]

Thus, in the summer of 1977, the automobile manufacturers indicated that although there were major financial and market risks, they felt they could meet the mandated 1980 to 1985 fuel economy standards with a "marketable product mix."

Light Truck Rule-Making

The 1981-1982 light truck fuel economy rule-making indicates the likely course of future fuel economy rule-making activity. As the proposed passenger car and light truck fuel economy standards become more stringent,[27] the required changes in product design and the associated manufacturing processes will be seen to cause significant changes in the nature and regional distribution of the motor vehicle industry workforce. In November 1977 a draft of the proposed 1980-1981 light truck fuel economy rule-making was sent out for interagency review as required in the rule-making process. Despite the legal requirement for confidentiality, the draft proposal was leaked to industry officials. In the industry's view, the proposed standards were quite restrictive. The industry reacted with a massive lobbying effort to modify the proposal before it became public. White House, congressional, and agency officials were contacted, including Treasury Secretary Blumenthal, Commerce Secretary Kreps, and Secretary of Transportation Adams. Despite this lobbying, the light truck fuel economy standards in the notice of rule-making, issued in December 1977, were basically unchanged from the draft that had leaked to industry.[28]

Prior to and during the January 1978 light truck public hearings, the manufacturers publicly disclosed possible plant closings. Chrysler indicated that it had been forced to postpone the conversion of its Jefferson Avenue plant in inner-city Detroit because of uncertainty on truck standards.

> We had planned to convert the Jefferson Plant to van production at a cost of $50 million. In the process, we would keep more than 3,000 jobs in the city of Detroit. We have been forced to delay that project until the question of truck standards is settled. We can't go ahead and commit millions of dollars to build vehicles that we know can't meet the regulations NHTSA is planning to impose on us.[29]

The arguments in the light truck public hearings and submissions were in marked contrast to those of the earlier passenger car hearings. Whereas 11 groups had participated in the passenger car hearings, 31 groups participated in the light truck hearings. The notice of proposed rule-making on the passenger car standards resulted in 48 responses to the public docket; the light truck rule-making brought in 326 responses.

Where testimony and submissions at the passenger car hearings had pertained to the technical and marketing risks associated with the standards, and to the potential health effects and diesel particulates, the presentations at the light truck hearings pertained primarily to potential unemployment and particularly to minority unemployment. For example, V. Lonnie Peak, Jr., a member of the Board of Trustees of New Detroit, Inc. said:

> In Detroit, who is affected? I am not here to wage a battle for Chrysler and other truck manufacturers. This is a battle for poor and black people. These people are the "who" that will be so severely affected. They are the ones who work in the plants. Heavy industry is a major employer of black and poor people. Blacks are not heavily employed in plastics. Blacks are not heavily employed in aluminum. Blacks are not heavily employed in aircraft production. Twenty-eight percent of all auto industry employees are black Americans, but in the cities the majority of assembly line workers are black.[30]

Gerald Smith, President of the Detroit Chapter of the National Association of Black Social Workers, Inc., had this to say about the situation:

> It stands to reason that aluminums and plastics are the building materials of the future if automobile companies are to successfully build lighter, more economical vehicles. Few minorities and women have skills or hold jobs in the aluminum/ plastics industries, as compared with the vast network of steel industries involved in producing automobiles. As vehicle production moves away from dependence on the urban located steel industry, toward the suburban located aluminum/plastics industries, urban job displacement will follow.[31]

Following the hearings and submission of additional information, the final 1980-1981 light truck standards were published in the Federal Register in March 1978. A comparison of the standards as originally proposed and the final standards (see Table 6) shows that the final fuel economy values were considerably less severe than those proposed before the hearings.

Table 6

Comparison of Proposed and Final Light Truck Fuel Economy Standards (Without Captive Imports)

Model Year	Proposed Rule (mpg)		Final* Rule (mpg)	
	2 Wheel Drive	4 Wheel Drive	2 Wheel Drive	4 Wheel Drive
1980	19.2	16.2	16.0	14.0
1981	20.5	17.7	18.0	15.5

*The actual standards include the following provisions:

- If EPA does not approve use of slippery oils in testing by January 1, 1980, then standard may be reduced 0.5 mpg.

- No reliance on dieselization was made in establishing the technological feasibility of meeting those standards.

- All domestic trucks under 8500 lb. gross vehicle weight are included; manufacturers may not include imported vehicles (captive imports) in calculating new fleet average.

- Manufacturers using only truck type engines (i.e., International Harvester) granted special one-time standards.

Industry and congressional reactions to the final standards were generally positive. General Motors and American Motors asserted that they could meet the new light truck standards in 1980 and 1981; Ford repeated an earlier announcement that they would spend $600 million to keep Ford light trucks as industry leaders in fuel economy; and Chrysler indicated that, although the 1981 light truck standards demand an increase in fuel economy beyond their current capability they had every intention of meeting the standards in both years.[32]

"Economic Practicality" and Fuel Economy

Background

The Energy Policy and Conservation Act requires that the fuel economy standards set for light trucks and for passenger cars be "economically practical." In the rule-making on the 1981-1984 passenger car standards, a standard was considered economically practical if it was "within the financial capability of the industry, but not so stringent as to threaten substantial economic hardship for the industry." NHTSA therefore analyzed several economic areas that would directly affect the industry's financial capability to convert to the production of fuel economical cars, which included making a projection of total car sales and thus potential revenue. In addition, NHTSA analyzed the economic effects of the standards on the consumer by comparing the decrease in lifetime operating costs (discounted to present value) resulting from improved fuel economy with the increase in motor vehicle prices associated with implementation of fuel efficient technology.

This "cost-benefit" analysis concluded that consumers' savings in gasoline and maintenance costs would be greater than the new car price increase required to cover costs attributable to the fuel economy standards. Potential macro-economic impacts were also analyzed, including the effect of the mandated standards on the gross national product, unemployment, and the Consumer Price Index. The change in these indices due to the imposition of the standards was small: "Essentially insignificant, amounting to much less than one percent of the value of these indicators."[33] A macro-analysis of the motor vehicle material supply industries was also provided, concluding

that "downsizing and material substitution would imply either slightly retarded or slightly accelerated growth rates."[34]

In the rule-making for 1980-1981 light truck standards, the consideration of "economic practicability" came to include a much more specific assessment of the possible effects of plant closings and relocations associated with meeting the standards as originally proposed.

Community/Regional Economics

There is increasing national concern about the possible impact of federal regulations on inner cities, low income households, and minority employment. This concern will be reflected in future rule-making activity. The substitution of light-weight materials and more sophisticated power plant technology are considered potential threats to minority and inner-city employment. UAW Vice President Marc Stepp recently proposed to the House Subcommittee on Labor Standards that legislation be enacted to govern plant relocation and closings to include advance notice of an impending plant shutdown with an intensive effort to provide alternative employment for affected workers - mobility assistance to make it easier for workers victimized by economic dislocation to relocate.[35]

A recent directive from the Office of Management and Budget also states that Executive Branch agencies shall prepare urban and community impact analyses of proposed policy initiatives.[36] Fuel economy regulations would be covered by this directive.

Industry Competition and Structure

The manufacturers' ability to generate the capital necessary to fund the changeover to fuel economical motor vehicles is strongly dependent on the general economic climate - to which new car sales are very responsive - and the marketability of the new products. Since the state of the economy and automobile sales have been cyclical, the requirements to meet mandated standards by specific dates - independent of the state of the economy - considerably increase the manufacturers' financial risk. Financial risk is greatest for the smaller manufacturers who do not have the same access as larger companies to capital resources to carry them through an economic downturn.

In its 1977 Annual Report, Chrysler Corporation complained:

> These standards impact more heavily on Chrysler Corporation than on its two larger competitors...
>
> The effect of these unreasonable standards is to have the government strengthen the competitive advantage of the largest manufacturers.[37]

The Ford Motor Company likewise complained:[38]

> It is ironic that the cumulative impact of government regulation may be to strengthen the position of GM and the imports and possibly weaken domestic competition in the automotive industry.

In a recent study, The Contributions of Automobile Regulations, NHTSA questioned the industry statements on the effects of regulation on industry structure.

It has been charged that despite efforts by some Government agencies to prevent concentration in industry, the regulators are fast bringing the automobile industry to the point where only the largest companies can survive. This assertion is easily refuted by the figures in Table 7, which shows the share of the market enjoyed by each manufacturer since the NHTSA regulations first became effective. As the table demonstrates there is no discernible trend in percent of market for any individual producer, much less an overall movement toward concentration.[39]

Table 7

Percent of Total U.S. New Car Registrations*

Year	GM	Ford	Chrysler	AMC	Imports
1968	46.7	23.7	16.3	2.8	10.5
1969	46.8	24.3	15.1	2.5	11.3
1970	39.8	26.4	16.1	3.0	14.7
1971	45.2	23.5	13.7	2.5	15.1
1972	44.2	24.3	14.0	2.9	14.6
1973	44.5	23.5	13.3	3.5	15.2
1974	41.9	25.0	13.6	3.8	15.7
1975	43.3	23.1	11.7	3.7	18.2
1976	47.2	22.5	12.9	2.5	14.9

*Reproduced from the Contributions of Automobile Regulations (Table 5, p. 21).

The available information suggests that, to date, the motor vehicle regulations have had little effect on industry competitive position; however, both Chrysler Corporation and the Ford Motor Company have expressed concern about their financial future because of the necessity for maintaining a continuing capital investment program, whatever the state of the economy. Future rule-making will have to assess the validity of these concerns.

<u>Inflation/Trade Balance</u>

Rule-makers will continually have to reassess the positive and negative effects of mandated fuel economy standards on inflation and on the balance of payments. In a White House meeting (April 1978), business leaders, including representatives of the motor vehicle industry identified regulation as a significant causal factor in inflation. Since that time the domestic automobile manufacturers have proposed - as one element in the fight against inflation - that (i) the 1981-1983 passenger car standards calling for 2 mpg annual increases in fuel economy be re-examined; (ii) the 27.5 miles per gallon standard not be raised because of the attendant cost and risk; and (iii) the 1982-1984 light truck standards reflect the load-carrying function of trucks and be increased at a slower rate than cars.

In order to reduce the capital requirement necessary to meet the mandated standards, the domestic manufacturers are sourcing components from overseas suppliers rather than producing them domestically. For instance, Chrysler Corporation will purchase more than $200 million in components from its newest partner, Peugeot-Citroen for use in a new line of front-drive compacts.[40] On the other hand, the massive capital

investments being made to meet the standards are resulting in improved domestic productivity. The net inflationary and trade effects of mandatory fuel standards remain unclear, therefore.

Energy Conservation Costs vs. Benefits

Secretary of Commerce Juanita Kreps has recently indicated the need for better understanding of the regulatory process:

> For each federal regulation it is essential to ask: What does it cost? What benefits are we buying? Do these costs and benefits accurately reflect our priorities? Is there a way to achieve the same benefits at lower cost.[41]

The industry has argued that in setting the level and rate of introduction of fuel economy standards, NHTSA should consider a cost-benefit analysis. General Motors, in their response to NHTSA's request for information on the 1984-1986 passenger automobile, has suggested that a study be done to "find the point at which the financial resources used in fuel production is close to the financial resources used for conservation per gallon produced or saved over the life cycle of the vehicle."[42]

As fuel economy standards are increased, the incremental petroleum savings become less - a doubling of fleet fuel economy from 25 to 50 mpg saves only one half as much fuel as a doubling of fleet fuel economy from 12.5 to 25 mpg - and, in the absence of significant technological innovation, the incremental costs become greater. Determination of the level of fuel economy at which fuel "production costs" equal fuel "conservation costs" would require information that does not currently exist, however. Further, it is not clear that energy replacement "production costs" are the best measure of energy conservation benefits. It is clear, however,

that as the fuel economy standards are made more stringent, rule-making will increasingly involve assessments of total consumer, industry, labor and societal risks compared to the total benefits of petroleum conservation.

Current and Projected Technological Innovations Contrasted

Current Technology Available

By 1985 the projected domestic new car fleet average fuel economy will be more than double its 1973-1974 value of about 13 miles per gallon. This increase will have been accomplished with relatively small changes in motor vehicle functional characteristics; interior passenger and baggage volume and performance will be about the same as at present. The 1975 industry predictions that mandatory fuel economy regulations would require a fleet of subcompacts have not come to pass. The fuel-efficient motor vehicle technologies now being commercialized in the U.S. market were developed, in large part, by Western European and Japanese motor vehicle manufacturers and suppliers in an environment of high fuel prices and horsepower taxes. The advanced electronic control technology currently being adopted, while not derived from the foreign auto industry, has been derived from technology developed in other industrial sectors.

The existence of fuel econonomy standards has unquestionably accelerated the commercialization and transfer of existing technology. The first round (1977-1982) of motor vehicle weight reduction was achieved by downsizing. In the next round (1982-1985) there will be increased emphasis on material substitution in body panels, structural members, and powertrain castings. The incremental weight changes associated with material substitution are smaller than those associated with the original downsizing programs, however.

The first round improvements in powertrain efficiency have been associated with engine resizing; four- and five-speed transmissions have been substituted for three-speed transmissions, while turbochargers have been used to preserve vehicle passing and acceleration performance. In the second round, more sophisticated actuators, sensors, and on-board micro-processors are being incorporated for more accurate engine control and improved fuel utilization. Diesel penetration is being increased with associated uncertainties in the health effects of diesel exhaust emissions. As in the case of weight reduction, the incremental improvements in powertrain efficiency are becoming more difficult to achieve.

Projected Technology Requirements

No Western European maker has a corporate sales-weighted average fuel economy as high as our 1985 requirement (27.5 mpg), although a number of individual production models are higher.[43] The available fuel efficient motor vehicle technology in Western Europe and Japan is rapidly being used up. If the nation chooses to increase motor vehicle fleet fuel economy further after 1985 it appears reasonable to ask the question: Will the anticipation of more stringent fuel economy standards be sufficient to generate the new technology required for another round of rapid and significant increase in fuel economy?

This question is controversial. Some say that the motor vehicle industry has the necessary resources and that it can be stimulated into action through product regulation. Others say that without knowledge of whether the regulation is feasible, the government is not in a position to make regulations stick; i.e., if the automobile companies say "no," the government has to have some basis for saying "yes."[44] According to this

view, the possibility of more stringent fuel economy standards may even be a deterrent to innovation since in developing new technology the industry will only be increasing the government's basis for demanding higher standards. Therefore, unless fuel economy improvement continues to be a marketable feature, the motivation for industry to show that it can exceed the 1985 mandated fleet average of 27.5 mpg is likely to be small.

The sources of motor vehicle technology are being depleted. If the nation chooses - on the basis of an assessment of the benefits and costs - that motor vehicle fuel economy should be further increased, the motor vehicle technology base, including safer lightweight structures and more fuel-efficient powertrains, must be replenished.

Summary and Conclusions

Effects to 1985

Petroleum Conservation

Mandatory fuel economy standards have proved to be a powerful instrument for stimulating improvements in new car fleet average fuel economy and in achieving the societal goal of decreased petroleum consumption. New car fleet average fuel economy will have doubled in the period from 1975 to 1985 with a resulting annual petroleum savings of 2 to 3 million barrels per day by the early 1990s.

Rejuvenation and Modernization

The accelerated capital spending required to meet the mandatory standards has provided the domestic motor vehicle manufacturers with a unique opportunity to modernize and rejuvenate their aging manufacturing facilities and put into place a more efficient and productive physical plant than previously existed.

Competition

The mandated standards have resulted in the domestic production of motor vehicles that may not only capture a significant segment of the domestic small car market, but may also be competitive in the world market.

Market and Financial Risk

The ability to generate the new capital necessary to fund the accelerated changeover to fuel economical motor vehicles is strongly dependent on the general economic climate and market acceptance of the new products. The financial risk is greater for the smaller manufacturers, who do not have the same access as the larger companies to capital resources to carry them through an economic downturn.

Prospects Beyond 1985

Technology Generation

The projected doubling of motor vehicle fuel economy by 1985 will have been accomplished, for the most part, by the use of mass-produced technology that had already been commercialized in Western Europe and Japan. It is not clear, however, whether the anticipation of more stringent standards in the post-1985 period will, by itself, result in the allocation of resources - trained manpower, equipment and capital - to the generation of new motor vehicle technology at a rate sufficient to achieve significant additional gains in fuel economy during the second decade of regulation. If fuel economy is to be increased, additional efforts - on the part of the industry and the government - will be required to replenish the technology base.

Policy Alternatives

Mandatory fuel economy standards have proved to be a powerful, and flexible instrument for increasing motor vehicle fuel economy, and are, therefore, likely to be employed again if the nation wishes to achieve further gains in fuel economy. As the mandated standards are increased, however, the resulting changes in motor vehicle design and manufacturing processes may have increasingly serious effects on certain industrial sectors, regions of the country, and segments of the work force. Since it is not possible at the start of rule-making to assess properly all the impacts of a regulatory decision, continuous reappraisal of proposed standards will be required as new information and knowledge is provided by interested parties. If, in the post-1985 decade, mandatory fuel economy standards are to continue to be useful as a strategy for stimulating fuel economy improvements, they will have to be supported by other federal policies both to stimulate the marketability of fuel economic motor vehicles and to mitigate the effects on affected groups in and outside the industry.

Footnotes

* The views represented herein are the personal views of the authors and do not represent any official position or findings of the U.S. Department of Transportation.

1. A background summary on automobile safety legislation is given in Philip A. Lorange and L. H. Linden's Automobile Safety Regulation: Technological Change and the Regulatory Process, Massachusetts Institute of Technology, Energy Lab., MIT-EL-77-036, Oct. 1977, Chapter 2, pp. 19-23.

2. PL 89-272, amendments to the Clean Air Act of 1963, Oct. 20, 1965.

3. HR 6599, March 16, 1971 and HR 3091, Jan. 29, 1973, House Interstate and Foreign Commerce Committee.

4. "Fume-Free '75," New York Times, Aug. 23, 1970, Section III, p. 12.

5. Energy Conservation Working Paper, Senate Commerce Committee Hearings, Dec. 10, 1974, p. 174.

6. "President Ford announces forced resignation of Federal Energy Administrator John C. Sawhill...,'" New York Times, Oct. 30, 1974, p. 8.

7. "Conferees Agree to Penalize Makers of Gas Guzzlers," Congressional Quarterly Weekly Report, Sept. 30, 1978, p. 2714.

8. Charles L. Schultze, The Public Use of Private Interest (Washington: Brookings Institution, 1977).

9. A summary of the characteristics of motor vehicle standards is provided in John B. Heywood et al., Regulating the Automobile, Massachusetts Institute of Technology, Energy Lab. report MIT-EL 77-007, Nov. 1977, Chapter 1, "The American System of Regulating the Automobile," by L. H. Linden and David Iverach, pp. 1-1 through 1-53.

10. The role of the federal Administrative Procedures Act in establishing the framework within which the regulatory process must function is developed in Eugene Goodson's, Federal Regulation of Motor Vehicles - A Summary and Analysis, Purdue University, prepared for U.S. DOT, March 1977.
11. Heywood, Regulating the Automobile, Chapter 5: "Another View of the Politics of Auto Emissions Control," by Howard Margolis.
12. A summary of the administrative history of fuel economy regulation is presented in Goodson, Federal Regulation of Motor Vehicles, pp. 14-29.
13. DOT Office of the Assistant Secretary for Systems Development and Technology, New Technology Initiatives, Internal Report, June 1971.
14. Transportation Energy Panel, Research and Development Opportunities for Improved Transportation Energy Usage, Report No. DOT-TSC-OST-73-14, Sept. 1972.
15. Energy Conservation Working Paper (Senate Commerce Committee (Nov.-Dec. 1974), hearings pp. 1 and 8.
16. President Gerald F. Ford, "The Economy," address before a Joint Session of Congress. Oct. 8, 1974, Weekly Compilation of Presidential Documents, Oct. 14, 1974, pp. 1239-1247.
17. U.S. House Interstate and Foreign Commerce Committee, Subcommittee on Energy and Power, Energy Conservation and Oil Policy, Part 2, Hearings, March/May 1975.
18. Heywood, Regulating the Automobile, Chapter 1, Laurence H. Linden and David Iverach, "The American System of Regulating the Automobile."
19. Administrative Procedure Act, 5 U.S.C., Sec. 553 as amended.

Footnotes (continued)

20. National Highway Traffic Safety Administration, Automotive Fuel Economy Program, First Annual Report to Congress, Jan. 1977, pp. 25-27. As part of the fuel economy rule-making process, NHTSA is required to: 1) Prepare an engineering draft of the proposed rule, describing technical specifics; 2) Prepare a rule-making support paper (RSP), preliminary impact assessment (PIA) and draft environmental impact statement (DEIS) if needed. The RSP provides technical basis for the PIA; 3) Prepare legal draft of proposed rule-making action; 4) Obtain concurrence of the Secretary and complete interagency coordination; 5) Publish Notice of Proposal Rule-making (NPRM) in Federal Register; 6) Collect comments from interested parties; hold public hearings as appropriate; 7) Incorporate information and comments into rule-making documentation; 8) Prepare final draft of proposed rule-making action; 9) Obtain concurrence of the Secretary and complete interagency coordination; 10) Publish rule in Federal Register.
21. National Highway Traffic Safety Administration, Automotive Fuel Economy Program, Second Annual Report to Congress, Jan. 1978, p. 33.
22. Henry Duncombe, NHTSA hearings on 1981-84 passenger car fuel economy, March 22, 1977.
23. William D. Balgord, NHTSA hearings on 1981-84 passenger car fuel economy, March 22, 1977.
24. Walter Adams, NHTSA hearings on 1981-84 passenger car fuel economy, March 22, 1977.

25. At the Senate Commerce Committee hearings on automobile fuel economy, July 1977, Herbert Misch of the Ford Motor Company said: "We will meet the fuel economy standards recently set by the Secretary of Transportation at levels substantially more stringent than we anticipated."

 Sidney Terry of Chrysler similarly confirmed that his company would meet the law: "We at Chrysler have made our commitment to meet the requirements of the law. We are well along in a multi-billion dollar program to redesign every vehicle we now make and to introduce a new line of lighter more fuel-efficient passenger cars."

 Frederick Stewart of American Motors put it quite simply: "There is no question as far as American Motors is concerned too, Mr. Chairman, we will meet the standards."

 Finally, GM's Dr. Henry Duncombe quoted GM President Elliot Estes, saying: "Now we are going to take the risk that we can meet the required fuel economy average in the 1980s and still provide a reasonable mix of attractive vehicles that will meet most of our consumers' transportation needs."

26. Elliot Estes, speech at Automotive News World Congress, June 1977.

27. The NHTSA Five Year Plan for Motor Vehicle Safety and Fuel Economy Rule-making indicates that NHTSA plans to perform the necessary analysis and issue notices of proposed rule-making and final rules for model year 1985 and 1986 passenger automobiles and for model year 1982 through 1984 light trucks in 1979; during the 1985 and 1986 passenger car rule-making activity the existing fuel economy standards for model year 1984 will be reexamined.

Footnotes (continued)

28. Saul Friedman, "Leaks Let Carmakers Zero In on Fuel Rules," Detroit Free Press, Jan. 6, 1978; "Tough Truck MPG Rules Stir Washington Ruckus," Helen Kahn, Automotive News, Dec. 19, 1977, p. 1.

29. Chrysler comment at NHTSA Light Truck (1980-81) Hearings, Jan, 16-17, 1978.

30. V. Lonnie Peak, Jr., New Detroit, Inc. NHTSA Light Truck Hearings, Jan. 17, 1978.

31. Gerald K. Smith, National Association of Black Social Workers, Inc., NHTSA Light Truck Docket FE 77-04-N01-059, Jan. 6, 1978.

32. "DOT Sets Final Truck MPG Rules," pp. 101-103.

33. DOT/NHTSA Rulemaking Support Paper Concerning The 1981-84 Passenger Automobile Average Fuel Economy Standards (July 1977).

34. Ibid., p. ES-15.

35. Marc Stepp/UAW Vice President and director of the Union's Independent Parts Supplier Department before the House Subcommittee on Labor Standards and to the Automotive News World Congress. "UAW Official Cities Grief Caused by Plant Closings," Automotive News, August 28, 1978, p. 9.

36. Office of Management and Budget, "Circular No. A-116 to the Heads of Executive Departments and Establishments on Agency Preparation of Urban and Community Impact Analyses," August 16, 1978.

37. Chrysler Corporation, 1977 Annual Report, p. 6.

38. Ford Motor Co., State of the U.S. Automobile Industry, June 13, 1978, p. 32.

39. NHTSA/DOT, The Contributions of Automobile Regulations, June 1978, pp. 19-20.

40. "Peugeot to Supply FWD Parts for '81 Chrysler Small Cars," Automotive News, Sept. 11, 1978, p. 4.

41. "Why We Need a Regulatory Budget," Juanita M. Kreps, U.S. Secretary of Commerce, Business Week, July 31, 1978, p. 14.

42. "GM Cites Difficulties to Clear in Meeting MPG Rule for '80s," by Helen Kahn, Automotive News, pp. 1 and 43. The article quotes from the nonconfidential portion of GM response to NHTSA fuel economy questionnaire, docket FE 76-01-N3, "General Motors Corporation on Request for Information on Passenger Automobiles Questionnaire for Vehicle Manufacturers," August 7, 1978.

43. "Europe Way of 1985 CAFE Regulations," Automotive News, Sept. 25, 1978.

44. Statement of Dr. Kenneth Arrow, Professor of Economics, Harvard University and President of the American Economic Association, at Hearings before the Special Subcommittee on Science, Technology, and Commerce of the Committee on Commerce, United States Senate, Federal Incentive for Innovation, Aug. 31, Sept. 4, 1973, Serial No. 93-57, pp. 20-33. Dr. Arrow testified that: "In fact, without a knowledge of whether the regulation is feasible or not, the Government is in no position to make such a regulation. There has therefore to be independent research, if for nothing else, merely to establish the feasibility..." p. 26.

Appendix 1

Executive Branch Activities on Motor Vehicle Fuel Economy - 1970 to 1976 (Non-Mandatory Fuel Economy Program)

Date	Action	Comment
June 1971	DOT study to determine major transportation energy conservation opportunities	The motor vehicle represented major opportunity to conserve energy in transportation.
Sept. 1972	DOT/EPA/NASA/DOD participated in study on "Energy Research and Development Goals" for White House Office of Science and Technology	Report projected that automobiles could achieve 30 to 40% fuel economy improvement and still meet emission goals.
Nov. 1972	EPA published report on Fuel Economy and Emission Control	Major findings were that vehicle weight is most instrumental factor affecting fuel economy.
Jan. 1973	Auto Energy Efficiency Program established at DOT's Transportation Systems Center	Program aimed at assessing auto industry's ability to improve auto fuel economy.
Oct. 1973	Arab oil embargo	Organization of Arab Petroleum Exporting States announced oil boycott.
Dec. 1973	EPA published the 1974 Gas Mileage Guide	Result of voluntary fuel economy labelling program.
Feb. 1974	Washington Energy Conference	Program of international cooperation to deal with world energy situations. New energy ethic to promote conservation.
June 1974	Request from Federal Energy Administration to auto manufacturers on feasibility of voluntary fuel economy program	Auto manufacturers asked to respond to feasibility of achieving 30% fuel economy improvement by 1985.
Aug. 1974	Industry response to FEA's request on feasibility of 30% fuel economy improvement by 1985	Motor industry responded positively to FEA request.

Date	Action	Comment
Oct. 1974	DOT/EPA Report on Potential for Motor Vehicle Fuel Economy Improvement (120 Day Study)	Report concluded that 40-60% improvement could be obtained in motor vehicle fuel economy by 1980. Became critical technical base for voluntary program and subsequent mandatory standards.
Oct. 1974	Congressional Address by President Ford on The Economy	Announcement of a goal of 40% improvement in new car fuel economy by 1980. Goal based on 120 Day Study.
Jan. 1975	Initiation of Voluntary Fuel Economy Monitoring Project in DOT	Project aimed at monitoring industry's progress toward fuel economy goal of 40% improvement.
Jan. 1975	State of Union Message	President Ford announced agreement by the manufacturers on the voluntary fuel economy program.
Mar. 1975	DOT Secretary Coleman asked by White House to head task force on Motor Vehicle Goals Beyond 1980	Task force to study long range goals compatible with environmental safety, and economic objectives.
Sept. 1975	FEA announced possibility of increases in fuel economy goals	Auto makers were achieving large gains in fuel economy, and Administration wanted to continue voluntary program in spite of congressional pressure.
Dec. 1975	Energy Policy and Conservation Act signed into law	Legislation called for 20 mpg in 1980 and 27.5 mpg in 1985. Over 100% improvement in fuel economy levels compared to 1973-1974 values.
April 1976	Dept. of Transportation's Monitoring Report on Auto Voluntary Fuel Economy Program	Final report on voluntary program concluded that future product programs would meet 1980 goal of 40% improvement.
Nov. 1976	Report by the Federal Task Force on Motor Vehicle Goals Beyond 1980	Report concluded that goal of 100% improvement in fuel economy by 1985 was achievable.

Appendix 2

AFEP Second Annual Report
(Summary of Rule-Making Activities for FY'77)

Rule-Making Activities					
Docket No.	Description	Publication Date NPRM*	Comments Closing Date NPRM	Final EIS**	Published Final Rule
FE 76-01	1981-84 Passenger Automobile Standards	2/22/77	4/12/77	6/1/77	6/30/77
FE 76-02	Reduction of Passenger Automobile Fuel Economy Standards	10/26/76	12/27/76	***	11/14/77
FE 76-03	Nonpassenger Automobile Standards 1979	11/26/76	1/10/77	3/3/77	3/14/77
FE 76-04	Exemption from Average Fuel Economy Standards	12/9/76	1/24/77	***	7/28/77
FE 76-05	Vehicle Classification	12/20/76	1/19/77	***	7/28/77
FE 77-02	Manufacturers of Multistage	2/9/77	3/9/77	***	7/28/77
FE 77-03	Automotive Fuel Economy Reports	4/11/77	5/11/77	***	12/12/77
FE 77-05	1980-81 Nonpassenger Automobile Standards	12/15/77 Public Hearing 1/16-17/78	1/30/78	3/15/78 (DEIS draft available to public 12/12/77)	3/15/78

Notes: *Notice of proposed rule-making.
**Environmental Impact Statement.
***Not applicable.

BEYOND AUTOCRACY: THE PUBLIC'S ROLE IN REGULATING THE AUTO

BRIAN KETCHUM AND STAN PINKWAS

CITIZENS FOR CLEAN AIR, INC.

The Post Autocratic State

The United States needs to reevaluate its attitudes toward automobiles. This means going beyond the simplistic notion that improving automobiles as consumer products, that making endless technical adjustments, will solve the social problems their use creates. But we will never do this by continuing to rely on the industry for our information, by continuing to accept its mythology, and by continuing to accept its definitions.

As a first step, Congress must investigate the social, economic and political consequences of our nearly total dependence on automobiles. The attempts that have been made - such as the Office of Science and Technology's report, "Cumulative Regulatory Effects on the Cost of Automotive Transportation" (RECAT),[1] the task force on Motor Vehicle Goals Beyond 1980, and the ongoing National Transportation Policy Study Commission - became as captive of automotive interests as most Americans are of their cars. Instead of helping us understand the consequences of our automobile use, their conclusions were routinely used to thwart further regulation. Meanwhile, government decisions about automobiles continue to be based on inadequate, skewed information and made with little regard for the societal effects of automobiles or the highways they require.

A long-term, decently funded commitment to support public participation in transportation decision making can help overcome this. But public participation demands technical expertise and few individuals or public organizations can afford its cost; corporations and foundations have already proven unwilling. Given the automobile industry's historic dominance of the regulatory process, the federal government would be justified in taking up the slack.

The government can do some of this fairly quickly. For example, the Department of Transportation and its National Highway Safety Administration (NHTSA) should expand their demonstration program to support public participation in federal rule-making procedures. Other agencies should begin similar participation programs.

Washington should also encourage the development of a corps of technicians who can independently evaluate such matters as automobile safety, emissions control, fuel economy, public transportation, and transportation planning and land use. There are no experts now available to the public for such work who are not already employed by industry or government: those experts that are available are understandably reluctant to provide the sustained involvement public participation demands. A modest effort could be funded for $10 million a year (or about one cent for every $400 that consumers spend on transportation).

The academic community should also begin to take a greater interest in transportation issues - especially in the social impact of automobiles Universities have the resources to investigate the problem and provide courses in the externality costs of automobile use. The socio-economics of transportation is a ripe, untapped area for exploration.

Finally, there is a need to investigate and reform the industry's posture toward the media. The trade and enthusiast press is heavily subsidized while the general press is alternately junketed and intimidated: the industry's economic clout with the media is a powerful propagandistic force that it is not afraid to use to shape public opinion or suppress unfavorable comment. For example, when we submitted an article about diesel emissions and public health to New Engineer magazine in 1978,[2] a major diesel automaker threatened to withdraw from advertising negotiations if the article

ran. It did, and the manufacturer carried out its threat. The price of New Engineer's integrity was about $100,000.

We have already embarked upon what Robert Heilbroner calls planned capitalism. Increasingly, its cutting edge will be the environmental impacts of manufactured goods. These impacts, says Heilbroner, "indicate the need for an unprecedented degree of monitoring, control, supervision, and precaution with regard to the economic process."[3] Elsewhere, he is more specific: "In the last quarter of this century the transportation industry will more and more provide the implementation for whatever transportation policy government determines to be in the best interest of national survival."[4] Heilbroner believes this is a welcome and necessary development for the nation and for the private transportation industry; that is, that it will help preserve the industry's profit structure for as long as possible.

On the whole, this is an accurate assessment and, though the auto/highway industry fights against every turn of the regulatory screw, it understands where history is leading it. For example, "the country must launch an integrated national planning program now...if the country is to meet its post-1990 surface transportation needs," said the Highway Users Federation to its members, adding that "the federation stands ready to help in this national effort."[5]

Yet transportation still needs to be integrated into the broad range of planning processes the government conducts, particularly those concerning land use and energy. President Carter noted in his 1977 energy message[6] that transportation accounts for 26% of all our direct energy costs. But he failed to note that the production of vehicles, spare parts and fuel, and the building, operation and maintenance of related facilities account for an additional 17%. This brings transportation's share of the energy budget up to 43% as Table 1 illustrates.

Table 1

1975 DISTRIBUTION OF TOTAL NATIONAL ENERGY CONSUMPTION

	Percent of Total National Energy Budget
Direct Transportation	
Automobile Fuel	11.8%
Truck Fuel	4.7
Air Fuel	3.5
All Other Transport Fuel	5.3
Subtotal	25.3%
Indirect Transportation	
Refining and Distribution of Fuels and Lubricants	5.3%
Construction, Operation and Maintenance of Loading, Storage and Maintenance Facilities for Private Trucking and all Common Carriers	4.3
Manufacture and Repair of Highway Vehicles Including Parts and Tires	4.2
Manufacture and Repair of Air, Rail and Marine Vehicles and Support Equipment	1.9
Construction and Maintenance of Highways	1.7
Subtotal	17.4%
Nontransportation	57.3%

Source: Adapted from "National Transportation, Trends and Choices," Figure II.15, p. 32, U.S. Department of Transportation, January, 1977.

Yet instead of substantive ideas for reducing transportation energy use, President Carter proposed passenger car fuel economy standards that were already law and excise tax rebates and inadequate gasoline taxes that were axed by Congress.

The last years have seen the beginning of a reasonable regulatory process but automobiles and highways still unreasonably pervade our lives. As Kenneth Schneider, another critic of the industry observed, "Unlimited multiplication of anything challenges the worthiness of what is created."[7] Public interest organizations can help devise the saner path we need to follow. More automobiles with better options can no longer substitute for legitimate progress. The myth of infinite resources is dead; conservation and rehabilitation are necessities.

The Mythic Opposition

There is almost no meaningful participation by the public in the automotive regulatory process. However, because certain aspects of the automobile, primarily consumer related, are coming under regulation, the idea has gained currency that there is a well-organized, well-funded grass roots movement opposing unregulated automobile production and its indiscriminate use. The welter of hearings and committees and the general huggermugger of lobbying supports the idea. Unfortunately, no organized movement exists. Although some economic and environmental realities are finally being recognized by the industry, the commercial imperatives of the assembly line still effectively dictate important social policies. In the meantime, the general public remains as excluded as ever from their formulation.

By 1979, there will be about 118 million automobiles and 31 million trucks in the U.S., more than one vehicle for every licensed driver. Interstates, highways and parking lots already determine the shape of our cities and towns, where people live, how they commute, where they will work. Approximately a

fifth of the labor force performs automobile- and highway-related work. Subways and railroads have atrophied, unable to compete with the automobiles; more than 200 communities have completely abandoned public transit. Hundreds of neighborhoods, primarily urban, have been ruined by unwanted roads. Tailpipe exhaust causes most of our urban air pollution, traffic accidents kill more people under 35 than any disease, and the miles we drive cost us virtually all of the oil we import. We can no longer live without automobiles, but neither, it seems, can we afford to live with them.

No one really knows exactly how excessive their costs have grown to be. The true costs of automobile use have always been obscured by a general refusal to include the costs of subsidies the industry demands from the government and the social costs of its products. The best estimate is that it costs the people of this country about $420 billion (in 1978 dollars) a year for mobility. This figure is so large that many refuse to believe it, but a rough documentation exists. As Table 2 illustrates, the auto/truck/highway share for 1978 is $352 billion, or 83.3%. As we shall see below, another $100 billion should be added to represent the societal costs of automotively induced air and water pollution, congestion, accidents, medical expenses, and government subsidies.

The automobile industry never acknowledges this oppressive side of its nature, preferring instead to posture itself as plagued by regulators and zero-growth environmentalists. Yet, despite its warnings and fulminations, the industry is healthy and growing. Indeed, NHTSA compellingly argues that its regulations have improved both the quality of Detroit's vehicles and the domestic industry's competitive position. Automotive retail sales totalled $144 billion in 1977, which is one-fifth of all the retail sales in the country. Since 1968, the net worth of General Motors and Ford has increased substantially and now exceeds

Table 2

DIRECT CONSUMER COSTS FOR ALL MODES OF TRANSPORTATION, 1970-1932

(Billions)

	1970	1971	1972	1973	1974	1975	1976	1977*	1978*	1979*	1980*	1981*	1982*
AUTOMOBILE COSTS	$ 92.3	$107.1	$117.9	$129.8	$137.8	$148.2	$172.9	$177.8	$193.3	$210.5	$229.2	$249.5	$271.8
TRUCK FREIGHT COSTS	69.2	79.3	92.1	102.5	107.7	112.0	130.7	143.6	158.7	175.6	194.4	215.2	238.5
HIGHWAY MODE SUBTOTAL	$161.5	$186.4	$210.0	$232.3	$245.5	$260.2	$303.6	$321.4	$352.0	$386.1	$423.6	$464.7	$510.3
FOR HIRE AND ALL OTHER TRANSPORTATION COSTS	38.3	41.1	44.3	49.6	56.4	58.0	60.6	64.4	70.5	76.8	83.9	91.5	100.1
TOTAL TRANSPORTATION COSTS	$199.8	$227.5	$254.3	$281.9	$301.9	$318.2	$364.2	$385.8	$422.5	$462.9	$507.5	$556.2	$610.4
HIGHWAY CONSTRUCTION AND MAINTENANCE COSTS**	$20.8	$22.5	$23.2	$24.2	$26.1	$28.7	$29.8	$32.0	$34.1	$36.4	$38.8	$41.4	$44.1

*Projected from Tables, pages 4 & 5, "Transportation Facts and Trends", July, 1977 and "Quarterly Supplement", January 19, 1978, Transportation Association of America, using a least-squares exponential regression of the 1965-1976 data.

**Source: "Highway Statistics Summary to 1975", Report No. FHWA-HP-HS-S75, Federal Highway Administration, 1978.

$24 billion; Chrysler's net worth increased modestly during this period. GM and Ford's ratio of after-tax profit to net worth also increased; Chrysler's fluctuated.[8] It should be recalled that GM, Ford and Chrysler account for 97% of domestic production and nearly half of world production through more than 200 facilities in more than 40 other countries.[9]

The automotive regulatory process is administered by the federal government through NHTSA (which is part of the Department of Transportation), the Federal Highway Administration (FHWA), and the Environmental Protection Agency (EPA). NHTSA regulates the fuel economy and safety characteristics of vehicles; FHWA regulates highways and roads, which is to say that it administers the Highway Trust Fund; and EPA regulates emissions and noise.

Participation by the public in these decisions has been exceedingly modest, often non-existent. It has also largely been confined to NHTSA's fuel economy and safety proceedings and EPA's emissions proceedings. Participation in highway controversies tends to occur at the city level and is often not even thought of as an aspect of automobile regulation.

Such regulation demands expertise because the automobile, even as a social problem, is ineluctably grounded in complex technologies. The industry's special interests know this and draw on their corporate members to finance the expertise they need. Organizations such as the National Automobile Dealers Association, the American Petroleum Institute, the Highway Users Federation for Safety and Mobility, the American Trucking Associations, the Motor Vehicle Manufacturers Association, and even the United Auto Workers, potently represent the transportation industry.[10]

They monitor and testify at hearings, contribute to congressional election campaigns, spend millions of dollars on their own research programs,

lobby intensively at all levels of government, produce their own publications, place their representatives in influential government positions, subsidize the trade press, and cultivate the general press. Estimates of the automobile industry's lobbying budget are as high as $500 million a year[11] and may well be conservative. For example, GM contributes heavily to obvious automobile lobbies but also to the American Public Transit Association and the Railway Progress Association.[12] These are cornerstones of the transit lobby, whose interests might be presumed to differ widely from those of the auto/highway lobby. GM, however, also dominates ground transit modes such as locomotives and buses: as Bradford Snell concluded in his landmark report to the Senate Subcommittee on Antitrust and Monoply, "Automakers embrace transit in order to prevent it from competing effectively with their sales of automobiles."[13]

The Highway Users Federation, which alone consists of more than 450 individual organizations, and the Motor Vehicle Manufacturers Association have a combined lobbying budget of more than $15 million a year, most of it contributed directly by GM, Ford and Chrysler.[14] Before 1970, the Federation was known as the National Highway Users Conference (NHUC) and was explicitly a creature of the automobile companies. It was founded in 1932 by Alfred P. Sloan, then president of GM, who served as its permanent chairman until 1948. Alfred Bradley succeeded Sloan as president of GM and as permanent chairman of NHUC through 1956. That year, the conference achieved its greatest success - creation of the Interstate Highway System and the trust fund financing mechanism. One result was that from 1956 through 1970 the federal government spent about $70 billion for highways (and, therefore, automobiles) and only $765 million for rail transit.[15]

Lest anyone imagine this influence to have abated, we have the direct testimony of Secretary of Transportation Brock Adams who told a 1977 gathering of the Highway Users Federation elite that "There is more power here in terms of what the transportation community can do...than any other place in the world."[16]

The base of much of this influence is the industry's mastery and distribution of information. The auto/highway lobby, as well as the manufacturers, conducts extensive public relations and advertising campaigns. The National Auto Dealers' Association, for example, launched one in November 1978 "to get more and more Americans to speak up for the automobile."[17] The campaign consisted of slick ads in national consumer and public interest magazines plus TV and radio spots. GM, Ford and Chrysler contributed $500,000, the lion's share of the initial financing. Less visibly, the Highway Users Federation in 1977 sent out 15 separate "Candidate Papers" to all congressional candidates, a "highway transportation information kit" to all newly elected legislators, and a new edition of its Highway Fact Book to all senators and representatives.[18]

The materials are slick in form and content. Increasingly, they argue against environmental criticisms by claiming that autos and highways are environmental necessities. The Highway Users Federation, for example, distributes a background document for editors that claims it is vitally important to complete the Interstate Highway System in order to: improve road safety and reduce accidents, reduce urban traffic congestion and air pollution, and conserve gasoline.[19]

Except for its scale, all this is no more than the routine politics of business. A study by Common Cause of federal regulatory agencies demonstrated that special interests have ten times more access to administrators than consumers.

The study explained that this is partly because the public has no one to speak for it on many of the issues that come before regulatory bodies.[20] In October 1978, Senator Edward Kennedy concluded from his own observations that special interest influence is so extensive that "representative government on Capitol Hill is in the worst shape I have seen it in my sixteen years in the Senate. The heart of the problem is that the Senate and the House are awash in a sea of special interest campaign contributions and special interest lobbying."[21]

In the automotive arena, special interests have the field virtually to themselves. Although many public interest and environmental organizations could justifiably be involved with transportation issues, none of the major organizations has a funded program dealing with the automobile - not Common Cause, not the the Sierra Club, not the National Audubon Society, not the Wilderness Society, not the Environmental Defense Fund, not even the Nader organizations.[22]

However, the field is not barren: Consumers Union looks after the integrity of the automobile as a consumer product; the Center for Auto Safety, directed by Clarence Ditlow, works to create safer cars and a safer driving environment; and Citizens for Clean Air, directed by Brian Ketcham, strives to identify and reduce the social costs of our dependence on automobiles. The Insurance Institute for Automotive Safety is also frequently cited as an effective voice of the public. But its real mission is to reduce the costs of the insurance industry. In fact, the insurance industry funds the Institute and is the special interest it represents. But, with or without the Institute, these few groups can hardly compete against the resources of Detroit.

This enormous imbalance has biased the federal regulatory process since its inception. There have been four major attempts to analyze the social impact of the automobile: the 1972 RECAT study; the 1976 study on Motor Vehicle Goals Beyond 1980;[23] the National Transportation Policy Study Commission; and the Congressional Office of Technology Assessment (OTA) Auto Study. Each of these efforts was heavily armored with special interest representation. The conclusions of the first two were so strongly pro-industry that they have been used ever since to argue against regulation.

RECAT, for example, was proposed in relative secrecy and written and released with almost no public involvement or comment. It reflected the automobile industry's assertions that emissions and safety regulations were too harsh and too expensive even as they existed in 1972. Though most of RECAT's conclusions have been discredited, its publication constituted a serious obstacle to standards under consideration at the time.

In 1975, the Department of Transportation created a task force from the personnel of several federal agencies[24] to prepare a major report on Motor Vehicle Goals Beyond 1980. The task force held four hearings during which it heard thirty-two speakers; thirty represented automakers, taxicab owners, the American Automobile Association, and oil and chemical companies; one represented the Sierra Club, and one represented the California Health Department. In addition, then Secretary of Transportation William Coleman refused to grant a request to incorporate in the study process a professional critique by public interest representatives.[25] The final report understated

the impact of the auto, virtually ignored auto-related externality costs, and endorsed diesel engines without so much as a look at their potential problems. Yet the automobile industry criticized the report for not going far enough even as they prepared to use it.[26]

In 1976, Congress established (under the Federal Aid Highway Act) the National Transportation Policy Study Commission "to report findings and recommendations with respect to the nation's transportation needs, both national and regional through the year 2,000."[27] This commission is still active and consists of six congressmen, six senators, and seven so-called "public citizens." One of these citizens represents an asphalt paving association, another is the chairman of a railroad, another presides over a highway construction company, another over a trucking company, another over an airline, and another over an auto dealership. Several are also involved in real estate investment and land development. The seventh citizen represents the Southern Pennsylvania Transportation Authority, but there is an enormous distinction between operating a transportation company and representing its passengers. Again we find the industry, in mufti, calling the shots.

The OTA Auto Study is similarly flawed and shows the same signs as its predecessor investigations of being unable to grapple with the societal impacts of automobiles and their use.

In each of these instances, the industry's self-interest easily overwhelmed the public interest. Yet the industry never abandons its defensiveness and frequently inveighs against the regulators, environmentalists, zero-growth freaks, and socialists it claims are arrayed against it.[28] Most of these

phrases are code words for consumer and public interest advocates who, in reality, constitute a relatively tiny opposition.

As a result, we know far less than is generally believed about the impact of automobiles on our culture. For example:

* How dependent are we on passenger cars as means of transportation? How do we define that dependence? In terms of available alternatives? In terms of costs? In terms of the allocation of natural resources?

* What federal policies and regulations have contributed to the automobile's rise to dominance and the decay of other modes of transit? What policy reforms might bring about a more equitable balance between automobiles and other modes? How can such reforms be effected?

* Is mass transit a viable alternative to automobile use? If so, what kinds of mass transit and under what conditions? If not, what alternatives are viable?

* What are the societal costs of automobile and truck use? How can they be accurately measured and plugged into planning processes?

* What are the impacts of our automotive policies on our foreign policies? On our balance of payments?

* Finally, what will we do in thirty years when we have 200 million autos and trucks and no gasoline: what is the real meaning of impending energy shortages?

Without government encouragement and sponsorship of the public interest, these questions are likely to remain largely unanswered and our economically unhealthy dependence on automobiles will probably increase.

Consuming the Auto

In a consumer-oriented society it is a basic tenet that consumers have a right to well-made goods. As a result, the public interest has been able to raise an effective if belated voice about automobiles as products.

The relationship between exhaust emissions and fuel economy illustrates the point. For years the industry insisted that low emissions could only be achieved at the expense of mileage. As if to prove this, domestic automakers selected the cheapest possible approach for controlling emissions from their 1973 and 1974 models. But the approach was technically deficient and the cars of those years are notorious for their poor mileage and performance. The two years linger in Detroit's memory like sour vintage. In the eyes of the public, they discredited emissions controls.

The suddenness of the 1973/74 Arab oil embargo and the gasoline shortages it produced intensified the growing resistance to emissions controls. Automobile makers and their allies blamed EPA and the Congress for forcing them to go with an inadequate control technology and, indeed, the public refused to accept the devices. But the main problem was Detroit's obsession with maintaining a low purchase price regardless of the effect on overall performance. It was a classic instance of a penny-wise, pound-foolish policy that is still costing consumers more in added fuel costs ($10 - $15 billion over the ten-year vehicle life cycle of the 1973/74 cars) than it saved them in initial purchase costs.

In the early seventies, Dr. William Balgord, now president of Environmental & Resources Technology, Inc., and Brian Ketcham set out to demonstrate that the industry was wrong. In 1973, Dr. Balgord built an

AMC Matador that operated below the original 1975/76 statutory emissions standards (0.4 HC, 3.4 CO, 0.4 NO_x) for 25,000 miles. In January 1974, they installed an advanced catalytic control device similar to the one used in the Matador into a Ford Pinto. Within five days, they had the Pinto meeting statutory emissions standards with a 20% improvement in fuel economy.

In a related area, Citizens for Clean Air challenged the industry's puffery of diesel technology as a satisfactory substitute for conventional spark-ignition engines. There is considerable evidence that diesels generate and emit carcinogens. While all the evidence is not yet in, there is enough to warrant taking a cautious approach. But portions of the auto industry have rushed to dieselize while insisting that diesels are perfectly safe. In March 1977 and in January 1978, Citizens for Clean Air testified before NHTSA about the evidence against diesel exhaust particulates and about the possible effects on health of the unregulated production of present diesel engines for widespread use in passenger cars.[29] Our intervention prompted the government to undertake its own research program and to begin drafting appropriate regulations for diesels.

Unlike EPA, NHTSA has recognized its need for independent data. As one result, it awarded Citizens for Clean Air a modest contract to develop and test advanced three-way catalyst technology on intermediate sized cars. This means that we are now in a position to demonstrate more conclusively that clean-running, economical, moderately priced cars are within the industry's capability. Part of Clean Air's research into diesels and its presentations before NHTSA were funded by a NHTSA demonstration project to support public

participation in federal rule-making proceedings. The project is an admission of the need for greater public representation in administrative proceedings. Though a model of understatement, the regulations describing it acknowledge that "it has sometimes been difficult for some consumer, environmental and other groups of citizens that are either widely dispersed or poorly financed to bear the cost of participating in federal regulatory proceedings. By contrast, better financed and organized groups, frequently representative of the regulated industry, are often able to participate vigorously and effectively... (and) may have a disproportionate influence on government decision making."[30]

Unfortunately, NHTSA's program is small and restrictive. For example, it compensates technicians at one-third the rate it compensates lawyers (reflecting the reality that lawyers write such programs). This insures that technical presentations cannot be fully funded. The project also requires applicants to prove their poverty. However, in Catch-22 fashion, payment does not occur until months after all work has been completed. This means that participants must pay all their own expenses anyway; in our case, we took out a loan.

The industry is ambivalent toward consumer improvements. On the one hand, it agrees that we need safer, cleaner, more economical cars. On the other hand, it disagrees with virtually every specific requirement that might make this principle a reality. Existing regulations are, therefore, all products of compromise and negotiation; they are extremely complex and detailed; some overlap, others are ineffective. However, automakers do not hesitate to cite their faults as a way of discrediting regulation in general.

Yet, automakers usually benefit from the improvements they have been forced to make. The industry has been driven to make overdue reforms and to monitor more closely the quality of its product. Eugene Bordinat, Ford's chief of styling, has even described for Newsweek how "a new safety standard covering bumpers led to a series of styling changes that ultimately resulted in a sweeping redesign of the 1973 Thunderbird - and turned it into a better selling car."[31]

From a consumer's viewpoint, the post-regulation automobile is a far better product than the pre-regulation automobile. It gets better mileage, runs cleaner when tuned, and comes equipped with seat belts and other mandated safety features. NHTSA estimates the added cost of safety features at $250 per car.[32] This is far below the industry's claims. NHTSA also estimates that the safety improvements it has forced Detroit to make have saved 200,000 lives since 1966.[33] Sales, meanwhile, have generally improved over the last years.

The automobile as a consumer product is, therefore, slowly coming under reasonable regulation. The needs of the industry are being served by the demands of its consumers and, though public participation in this process has been exceedingly limited, its input has tended to go a long way.

But the number of public interest organizations that now participate can be counted on the fingers of one hand and, as the industry's more flagrant abuses come under control and the issues become increasingly technical, public participation will become more expensive and more difficult to maintain.

The Costs Nobody Counts

The genius of the auto industry has been its ability to transform its own need to divide and manufacture into a strategy of regulation by division. Given this impetus - and the natural tendency of a bureaucracy to subdivide as it multiplies - the regulatory process has grown along fragmented and narrowly defined lines. Even now, it functions under the illusion that a complex social force such as the automobile can be productively governed by regulating it only in terms of its component characteristics.

This is regulatory failure - and a major consequence has been that the real costs of automobiles are still poorly understood. The industry denies them, governments do not understand them, no one properly examines them, and the public pays. Since these costs go unrecognized, they also go unregulated.

The sticker price on a new car reflects a small part of the ultimate cost to its purchaser and virtually none of the costs that will be borne by society at large. According to our best estimates these little understood societal costs affecting health, the environment and urban economies amount to $100 billion each year or, broken down, to about $10,000 added to the sticker price of every new car that is sold.

Traffic congestion is probably the most visible of the automobile's broader impacts. Indeed, it is the common cold of most cities, and as resistant. It also resists costing out. While there are no national figures, the cost for New York City has been estimated at $661 million a year.[34] This includes only the substantial personal time consumed in static traffic and not the increased cost of doing business, which is passed on to consumers.

In 1974, the National Academy of Sciences estimated that automotive-related pollution causes up to 4,000 deaths and four million sick days each year. The cost to society for this is $5 billion. Adjusting this 1974 figure for inflation (26.3% between 1974 and today) raises the bill to $6.31 billion.[35] The chronic noise and stress levels so many people are exposed to by their proximity to or dependence on automotive traffic have been increasing slowly but perceptibly. Their effects on health are real.

Auto accidents have more calculable effects and, regardless of the 55 mph speed limit, their casualties still exceed those of many wars. In 1977, this meant more than 47,000 deaths, 4 million injuries, and more than 22 million damaged vehicles. NHTSA estimated their cost at $43 billion, exclusive of pain and suffering.

Automotive water pollution is another of the automobile's environmental impacts. It is ignored because it is difficult to quantify. For example, the salt used to quickly de-ice roads contaminates water tables, thus necessitating more expensive water treatment plants. The corrosive properties of road salt are also partly responsible for the structural decay in 100,000 of our bridges.[36] Oil from highway run-off also finds its way into water and eventually onto beaches. The New York State Department of Environmental Conservation estimated that a third of the oil found in the region's waters comes from this source.[37]

Though the auto/highway lobby likes to pretend that everything is paid for out of various user fees and taxes, automobiles receive considerable government subsidization. According to a FHWA forecast,[38] these extra government-supplied funds came to $10.92 billion in 1978: $1.860 billion from property taxes and assessments; $6.652 billion from general fund appropriations; $1.915 billion from investment income; and $491 million from miscellaneous taxes and fees.

These monies were collected at all levels of government - federal, state, county and municipal - and applied to the automobile, primarily in highway construction and maintenance. Furthermore, user fees do not fully cover such auto/highway-related expenses as police and safety measures; administration, planning and design costs; and the interest payments on highway-related bond issues. These constitute substantial subsidies paid by the general public to motorists and the motoring industry.

One final example: there is now more land in the United States covered with pavement than with housing. This is land that is effectively off the tax rolls, unavailable for taxable growth. New York City's streets and highways cover some of the most valuable realty in the world and add up to about one-third of the city's acreage;[39] but because they provide no direct income of their own and have long since become too expensive to maintain, they now seriously endanger New York's economy.

When such externalities are considered, it is invariably in a context that precludes the industry's culpability. For example, traffic congestion and sprawl are thought of as municipal political problems, air quality as a state responsibility, lung diseases and stress as medical problems, commuting time as a personal decision. Most of the public efforts to regulate automobiles, therefore, occur at local, state and regional levels. In fact, many areas have yet to acknowledge explicitly that they are attempting to regulate automobiles along with "highways" and "air quality" and "congestion."

There are at least 20 areas around the country where new or planned interstate highways actively encroach on municipal budgets and priorities.[40] In these cities, the transportation planning processes have largely bogged down because of the long, bitter controversies that have arisen over auto use and its appropriation of limited capital funds.

It is symptomatic of our growing reliance on technology that most of these struggles revolve around environmental impact statements (EISs). Mandated by the National Environmental Policy Act of 1969, their writing has evolved into a scientific cottage industry. At the same time that they have become indispensable they have also become enormously complicated, technically sophisticated, and expensive to write and review. The upshot is that the public cannot meaningfully participate in issues based on EIS analyses without access to costly expertise.

EISs were originally intended as tools that the public could use to determine a project's anticipated effects on the environment. Instead, they have largely become scientific apologies for political decisions made in disregard of basic environmental and social considerations. In general, they are written to satisfy federal planning and funding requirements and with little or no meaningful contribution by the public. After reviewing more than fifty EISs in the past eight years, we have yet to find one that is not biased in favor of construction.

EISs that relate to automobiles tend to be about highway projects. In New York, for example, we are participating in an effort to trade in for subway rehabilitation funds a proposed 4.2 mile, $1.4 billion real estate/interstate project known as Westway. Backed by the city's construction, realty, and banking interests, Westway has been promoted as the key to New York's

rehabilitation. In fact, at more than $5,000 an inch, it will threaten adjacent communities, increase air and water pollution, increase the city's congestion, further erode its already damaged subway system, and appropriate for automobiles the city's meager capital resources.

Though the choice between automobiles and the general population seems absurdly clear in this case, maintaining the technical expertise to defend it has become an overwhelming burden. One of the major obstacles has been the EIS, which the West Side Highway Project (a quasi-public body created to build the interstate) spent $16 million in federal funds to develop. This is more than twice the sum spent to write the EIS for the considerably more expensive Alaska pipeline.

The highway project used about $9 million of its EIS money to create an elaborate mathematical model for predicting traffic levels and air quality. This model has become the basis for many of the crucial hearings involving the project. Unfortunately, it is incomprehensible to almost anyone without a doctorate in mathematics or engineering. As a result, no more than a handful of people in the entire city can even follow the arguments at these hearings, much less understand the level of detail. The general public, meanwhile, is uninformed and outside the decision-making process.

In Connecticut, the highway interests are pressing for an unneeded and unwanted $200 million expressway, known as Route 7, between Norwalk and Danbury. Again, the key analysis is the EIS. As it happens, this particular EIS is unusually poor. Connecticut's Department of Transportation did little or no field testing of its projections, relied on weak and manipulated information,

concocted speed and travel characteristics drastically different from those that exist, ignored the development the highway is intended to encourage, ignored its harmful impact on an adjacent AMTRAK commuter line, relied on an antiquated and deficient air quality report, and refused to consider meaningful alternatives. Indeed, the department even admitted that most of its highway planning is totally theoretical. The FHWA found none of these failings serious enough to delay its rubber-stamp approval process.

But Westway and Route 7 are exceptions. Public interest groups have gathered the expertise to prevent their construction. Such expertise is not generally available: technicians prudently consider their careers before accepting such assignments and few public organizations could afford the expertise were technicians available. This means that most of the urban interstate highway projects now in litigation, about $10 billion worth, will be built without adequate public review.

The regional picture is equally grim. In most areas, the transportation planning process required by the Department of Transportation is carried out behind closed doors. The New York/New Jersey/Connecticut Tri-State Regional Planning Commission, for example, operates as something of an invisible branch of government. As the region's lead planning body, Tri-State is responsible for guiding the flow of hundreds of millions of dollars of federal transportation funding each year. Yet, its meetings are unpublicized, inordinately long, tedious and insubstantial; its documents are difficult to understand; and its very existence is unknown to many of the area's editors and reporters.

Although it is routinely criticized for its refusal to encourage public participation,[41] it changes little from year to year. It even ignored its own internally funded study, which recommended that it reach out to the public.[42]

Meanwhile, New York (and most other states) are now revising their transportation plans in accordance with the 1977 Amendments to the Clean Air Act. The goal of the Act is to reduce automobile pollution in urban centers by developing reforms that would reduce automobile use and improve public transit.

In New York, such a plan was prepared and adopted in 1973. But it was never implemented. New York State and City encouraged public opposition and Mayor Abraham Beame spent his entire administration fighting the plan in court. Though he lost every hearing, he successfully prevented its implementation. Because of this recalcitrance, the 1977 Amendments instructed New York State to revise both its plan and its attitude toward the public. Late last year, New York began to move. But its new plan and new public participation program appear, as of this writing, to be amateurish and insincere attempts to compress two years' worth of work into less than four months. The general public, meanwhile, is unaware of what is happening and New York's overall hostility to this program has been abetted by the failure of EPA and the Department of Transportation to help the public become involved.

All of these situations demonstrate the importance of seriously regulating the automobile industry, in terms of its products (through emissions, safety regulations and the like) and in terms of how its products are used (through comprehensive and open planning processes). But this requires a holistic approach: regulations cannot be made and implemented piecemeal and expected to work.

Given existing conditions, such a holistic approach will be a long time in coming. The public interest community can speed its realization by more actively engaging in the politics of transportation, in particular by working for the internalization of the societal costs of the auto/highway mode. The government, meanwhile, can encourage public participation by helping the public develop the resources and expertise without which it can neither follow events nor represent itself.

To build a public constituency, to help the public understand what is happening, to help the public have some meaningful say in what is happening: these seem to be beyond the pale of the transportation industry's pursuit of profit and the government's ability to support. Yet, without a reasonable input into the country's burgeoning transportation planning processes, the public will never be able to challenge the imperious hold automobiles have on most American cities or even effectively to regulate how passenger cars are used within urban bounds.

Footnotes

1. Final Report of the Ad Hoc Committee, Cumulative Regulatory Effects on the Cost of Automotive Transportation (RECAT), Office of Science and Technology, Washington, D.C., February 1972.
2. Brian Ketcham and Stan Pinkwas, "Diesels and Man: Are We Creating a New Environmental Problem by Solving an Old One?" New Engineer, April 1978.
3. Robert L. Heilbroner, "Reflections. Boom and Crash," The New Yorker, August 28, 1978, p. 71.
4. Robert L. Heilbroner, Business Civilization in Decline (New York: W.W. Norton & Co., 1976), pp. 36-37.
5. Highway Users Federation, 1977 Annual Report, p. 10.
6. Executive Office of the President, Energy Policy and Planning, The National Energy Plan, Wash., D.C., April 1977.
7. Kenneth R. Schneider, Autokind vs. Mankind (New York: W.W. Norton & Co., 1971), p. 226.
8. National Highway Traffic Safety Administration, The Contributions of Automobile Regulation (Preliminary Report), Wash., D.C., June 1978, pp. 26-31.
9. Bradrord C. Snell, American Ground Transport: A Proposal for Restructuring the Automobile, Truck, Bus, and Rail Industries, presented to the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, U.S. Senate, Wash., D.C., Feb. 26, 1974, p. 10.
10. A full roster of the auto/highway lobby is beyond the scope of this article but even a partial list is enough to illustrate its breadth and strength. Thus, we have: the American Association of State Highway and Transportation Officials, the American Automobile Association, the American Imported

Automobile Dealers Association, the American Iron and Steel Association, the American Petroleum Institute, the American Public Transit Association, the American Public Works Association, the American Retail Federation, the American Road and Transportation Builders Association, the American Society of Civil Engineers, American Trucking Associations, Inc., the Associated General Contractors of America, the Automotive Information Council, the Automotive Legislative Council of America, the Automotive Liaison Council, The Automotive Parts and Accessories Association, Automotive Service Councils, Inc., and the Automotive Service Industry Association.

Also: The Committee for Automotive Dealers, the Diesel Automobile Association, the Highway Users Federation for Safety and Mobility (and its 90 state, regional and local chapters), the Independent Dealers Committee Dedicated for Action, the International Council of Shopping Centers, the Iron and Steel Institute, the Motor and Equipment Manufacturers Association, the Motor Vehicle Manufacturers Association, the National Association of Industrial Parks, the National Association of Manufacturers, the National Automobile Dealers Association, the National Auto Muffler Association, the National Automotive Radiator Service Association, the National Parking Association, National Realty Association, Inc., the National Merchants Association, the National Tire Dealers and Retreaders Association, the Transportation Association of America, the Transportation Research Board, and the U.S. Chamber of Commerce.

11. Snell, American Ground Transport, p. 95. See Footnote 300; Snell cites estimates ranging from $100 million to $500 million.

12. Ibid., p. 46.

Footnotes (continued)

13. *Ibid*., p. 46.

14. *Ibid*., p. 45.

15. *Ibid*., p. 45.

16. Highway Users Federation/Automotive Safety Foundation, 1977 Annual Report, Wash., D.C., p. 1.

17. "NADA moves ahead with ad campaign to back 'Automobility'," *Automotive News*, Detroit, Oct. 23, 1978.

18. Highway Users Federation, 1977 Annual Report, p. 1.

19. Highway Users Federation, *Editor's Resource*, Wash., D.C., Oct. 25, 1978.

20. Common Cause, *With Only One Ear: A Common Cause Study of Industry and Consumer Representation Before Federal Regulatory Commissions*, Wash., D.C., Aug. 1977.

21. Sen. Edward M. Kennedy, "Climbing Mountains with Phil Hart," the Philip A. Hart Lecture, Lake Superior State College, Sault Ste. Marie, Michigan, Oct. 23, 1978.

22. The public interest and environmental community has grown considerably in the last decade but, with the exceptions noted in the text, such organizations do not fund programs dealing with the automobile. A partial roster includes: the American Council on the Environment, the American Lung Association, the American Medical Association, the American Public Health Association, the Center for Auto Safety, the Center for Transportation Policy, Citizens for Clean Air, Inc., Common Cause, Consumer Action Now, the Consumer Federation of America, Consumers Union, Energy Action, the Environmental Defense Fund, the Exploratory Project for Economic Alternatives, the Highway Action Coalition, the Institute for Policy Studies, and the Institute for Public Transportation.

Footnotes (continued)

Also: The League of Women Voters, the National Audubon Society, the National Clean Air Coalition, the National Committee for Auto Crash Protection, The National League of Cities, the National Wildlife Federation, the Natural Resources Defense Council, Public Citizen, the Public Interest Economics Foundation, Public Interest Research Groups, the Public Resources Center, the Sierra Club, the Wilderness Society, and the Urban Land Institute.

23. Report by the Federal Task Force on Motor Vehicle Goals Beyond 1980, Washington, D.C., Sept. 2, 1976.

24. The agencies were: the Council on Environmental Quality, the Dept. of Commerce, the Dept. of Defense, the Dept. of Health, Education, and Welfare, the Dept. of Labor, the Dept. of Transportation, the Dept. of the Treasury, the Domestic Council, the Energy Research and Development Administration, the Environmental Protection Agency, the Federal Energy Administration, the Federal Highway Administration, the National Aeronautics and Space Administration, the National Highway Traffic Safety Administration, the National Science Foundation, the Office of Management and Budget, and the Urban Mass Transportation Administration.

25. Letter from Assistant Secretary of Transportation Hamilton Herman to Brian Ketcham, Vice President, Citizens for Clean Air, Inc., Feb. 26, 1976.

26. "Automakers Object to Optimistic View of Task Force Report," Automotive News, Nov. 1, 1976.

27. "National Transportation Policy Study Commission, Open Meeting," Federal Register, Vol. 42, No. 91, p. 23887.

Footnotes (continued)

28. The Diesel Automobile Association, in particular, indulges in such characterizations. Its members strongly attacked Dr. Delbert Barth, then the EPA's deputy administrator for health and ecology, over the agency's diesel emissions research program (calling it part of a "witchhunt by environmentalists") at a DAA conference at the New York City Statler-Hilton on Nov. 28-29, 1977. Meanwhile, Vol. 1, No. 1 of Diesel Motorist, the DAA's magazine charged that energy and environmental regulations were written by "alternate life-style folk running their nonsense through computer banks in agency basements."

    When a brief, oral version of this paper was presented at this symposium, Sydney Terry, Chrysler's vice president for consumer affairs, implied that Brian Ketcham was a card-carrying Communist and Maoist sympathizer hiding behind a public interest persona. NHTSA's The Contribution of Automobile Regulation, cites other less vituperative criticisms of the regulatory process by Henry Ford, II, Lee Iacocca (then with Ford), and Thomas Murphy and John Riccardo of GM and Chrysler, respectively.

29. Brian Ketcham, P.E., Dr. William D. Balgord, and Stan Pinkwas, Final Report to the National Highway Traffic Safety Administration on Nonpassenger Automobile Average Fuel Economy Standards, Model Years 1980-81, Citizens for Clean Air, Inc., Feb. 7, 1978.

30. Department of Transportation, National Highway Traffic Safety Administration, "Financial Assistance to Participants in Administrative Proceedings. Final Rule and Advance Notice of Proposed Rulemaking," Federal Register, Jan. 13, 1977, Part VIII, p. 2864.

31. "A Sculptor on Wheels," Newsweek, Oct. 23, 1978, p. 80.

32. NHTSA, p. ii.

33. Ibid., p. 32.

34. Brian Ketcham, Stephen F. Wilder and Stan Pinkwas, "Table 19: Annual Costs of Weekday Congestion by Mode," The Cost of Congestion, Appendix L, Citizens for Clean Air, Inc., Oct. 1978.

35. Brian Ketcham, Societal Cost Accounting; A New Tool for Planners - The Auto vs. the City, Citizens for Clean Air, Inc., New York, Oct. 1976, p. 7.

36. Vasil Pappas, "Pittsburgh Is Facing Problem That Once Hit London Bridge," The Wall Street Journal, Nov. 18, 1976.

37. Ketcham, Societal Cost Accounting, p. 8.

38. Department of Transportation, "Income From the Nation's Highways Will Be Almost $35 Billion in 1978," Press Release, Feb. 9, 1978, Table HF-11.

39. The developed land has been valued at about $81 billion. Ketcham, Societal Cost Accounting, p. 12.

40. The Phoenix-Papago Freeway in Arizona, the Hawthorne-Century Freeway in California, the Rocky Hill-Farmington Freeway and Route 7 in Connecticut, the Chicago Crosstown Freeway in Illinois, I-3 in Honolulu, I-93 in Massachusetts, I-696 in Detroit, Franconia Notch in New Hampshire, I-78, I-95 and I-287 in New Jersey, Westway in Manhattan, I-40 in Durham, I-80 between Allentown and Bethlehem in Pennsylvania, I-476 near Philadelphia, I-40 in Memphis and I-440 in Nashville, I-95 in Virginia, I-90 in Seattle, and the Inner Loop in Washington, D.C.

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41. New York State Legislative Commission on Expenditure Review, Tri-State Regional Planning Commission Programs: Program Audit 4.1.75, May 5, 1975.

42. Michael J. McManus, The Need for a Major Overhaul of the Tri-State Regional Planning Commission, Tri-State Regional Planning Commission, New York, March 29, 1977. Both this and the above report cite numerous other critical sources.

43. Ketcham and Pinkwas, Diesels and Man.

TOWARD MORE EFFECTIVE ORGANIZATION FOR PUBLIC REGULATION

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Questions of "institutional capacity" and strategy are familiar to both regulators and to private sector managers. For example, when EPA considers whether it has the technical and legal talent necessary to promulgate a set of regulations, it is evaluating its own institutional capacities. Similarly, when managers of automobile firms assess the "fit" between the size, location, and autonomy of dealers or the effects of advertising style and prices on sales, they are addressing questions of corporate capacity and strategy for operating in a specific market environment.

Despite this familiarity with strategic concepts, however, managers in the private sector and policy makers in the public sector typically lack specific and well-articulated strategies for dealing with regulatory realities. Managers often see regulation narrowly as increased dollar cost and uncertainty, thus failing to recognize the legitimacy, managerial significance, and competitive implications of regulatory actions. Policy makers, on the other hand, often see regulations narrowly as either an administrative or a policy problem, thus failing to recognize the diversity of legitimate competing interests that are created by regulations and expressed in the dynamic process of economics and politics.

The goal of all studies of institutional capacity is to improve an organization's abilities to use its limited economic and managerial resources to achieve well-defined and socially valued objectives. In the private sector, this means using resources more efficiently by properly

matching institutional strengths with corporate goals and market realities. In the public sector, it means adopting regulatory policies that increase the probability of specific government programs fulfilling their reasonable and desired purposes, minimize costs and undesirable side effects, and reconcile any conflicting objectives.

In the closely regulated world of the automobile industry, questions of institutional capacity are basic and pervasive. For example, the administration of a strong emissions control policy has significant consequences for the individual firms within the industry and for the cost of transportation to consumers. Does the EPA have the necessary political capacity to identify and respond to the legitimate equity interests of the differentially affected firms and citizens? Or is its capacity strictly technical? Do automobile manufacturers, parts suppliers, and consumers have the capacity to identify and articulate their interests? Or are they so poorly organized and politically unsophisticated that their legitimate interests are poorly articulated and ignored?

Questions of strategy are also basic and pervasive. The discretionary strategic choices managers and policy makers make today expose their institutions to the effects of future changes in the environments in which they operate. Thus, while all comparable institutions may be simultaneously subject to the same set of external economic and political factors, the relative importance of a particular factor to an individual organization will depend upon its history of strategic decisions.

The lack of attention to issues of institutional capacity and regulatory strategy can be traced, at least in part, to a generally poor understanding of the complex nature of the regulatory process. Therefore,

before we can address specific issues of capacity and strategy, we must describe the regulatory process.

Public Needs and the Regulatory Process

Figure 1 presents one characterization of the regulatory process. As it shows, the public's need for collective action, and associated conflicts about the extent and effects of that action, are central to the regulatory process. The public's demand for outcomes requiring joint effort - such as clean air - justify and legitimize government intervention in the private economy.[1] Different people place quite different values on collective goals, however; some individuals demand very high quality air and will make large sacrifices to obtain it. Since alternative public policies imply very different distributions of the burden of achieving such a goal, the politics of collective action cannot usefully be disentangled from the economics of collective action.

The debate over effluent taxes as a means of achieving socially desirable levels of automobile emissions illustrates the point. As can be seen from Lawrence White's paper in this volume, most of the arguments for and against effluent fees on automobile emissions relate to questions of economic efficiency. We contend that the debates over the allocational efficiency of effluent fees are incomplete and misdirected. Such debates are incomplete if they do not take account of the political realities affecting effluent fees. They may also be misdirected, however, in that much analytical attention that might fruitfully address the distributive consequences of such fees is devoted instead to questions of administration and implementation. Indeed, Congressman David Stockman's (favorable) comments

on White's paper reflect his concern for the political and distributional attributes of effluent fees, not merely their efficiency attributes. The Congressman's implicit "model" of the regulatory process thus simultaneously accounts for the political as well as the technical dimensions of regulation.

The differing values placed on outcomes and the distributional effects of alternative policies can create important and legitimate conflicts among individuals, which the political system must attempt to overcome. Two factors, in particular, complicate this process.

First, in addition to the public benefits and costs entailed, every program confers private benefits and imposes private costs, which may accrue to producers, consumers, or even bureaucrats. Producers of emissions control devices, for example, and consumers whose property's value will rise as a result of having cleaner air in their neighborhood have a very clear private interest in the emissions control program. To complicate matters further, however, people may also obtain such private benefits by using the coercive power of government regardless of whether there is a public interest at stake. Thus, if the government mandates airbags on all cars, people who value them can get them more cheaply because of production economies. These people will have used government to obtain a private benefit at the expense of those who did not value the accessory. In any given situation, it is impossible to disentangle public and private motives. The latter often come cloaked in arguments about the public good. One important capacity of public institutions, therefore, is the ability to recognize and respond to conflicts about legitimate public interests while distinguishing the private interests involved.

Second, collective goods - which are the usual objects of public regulation - share the "free-rider" characteristic: it is not possible to deny the benefits of the collective good or outcome to those who refuse to contribute to its provision. Not only is there no incentive for anyone personally to attempt solutions to the public problem, there are strong incentives to avoid even doing one's "fair share" while encouraging others to take the necessary action.

Interests and Interest Groups

A natural outgrowth of the interests, both public and private, associated with collective goods and governmental policies are formal organizations to represent and promote these interests. An understanding of the limitations and variations in interest group influence is therefore critical to an understanding of the regulatory process. For one thing, interest groups encounter the same free-rider problem characteristic of public goods. Since each individual has the incentive not to contribute to the interest group, but to hope that others' contributions and activities will be sufficient to achieve the desired policy, it can be very difficult to organize an effective interest group.

The precise nature of the interests, public or private, bears on the ease with which interest groups can organize, and on their potential effectiveness. Interests that are intensely felt by a highly concentrated group of individuals are easier to organize, and then more influential, than interests that affect each individual less, even though the number of potentially affected individuals may be very large. If the affected population is small, easily identified, and visible to each other, group consciousness may even overcome the free-rider problem.

If the potential gains to collective action for each individual are large, many of them may be induced to pursue the common goal regardless of the fact that noncontributors will also benefit. Interest groups will often frame issues, therefore, in terms designed to generate this type of support. Their appeals are frequently couched in symbolic, moral, and emotional terms so that individuals can feel that a whole way of life or great principles are at stake. (This may indeed by the case: the minority rights, anti-abortion, and environmental campaigns are examples.)

Interest groups play a more important role in the political process than merely pursuing the public and private interests of their members. In the adversarial model of regulation it is expected that the conflict and debate among contending interest groups will identify the broader range of public and private interests affected by public action, provide relevant information to the public, and through discussion and compromise yield final policies that reflect the full range of interests. Presumably, even unorganized interests among the public will have their preferences represented and championed by one or another of the organized groups. Thus, while "consumer" interest groups press demands for energy conservation and safer cars, the automobile industry represents by proxy the interests of those consumers more concerned with automobile performance and cost; the electrical industry perhaps champions an alternative to the internal combustion engine while the petroleum industry defends it and so forth. In theory, the behavior of these groups will leave few of the public's interests unrepresented.

This interest group model of the governmental process has some clear weaknesses. We have already argued that the characteristics of public and private interests inherently favor the formation and influence of some

potential interest groups - smaller groups of more intensely affected persons - relative to others. Thus, environmental and consumer groups were slow to form and still face a continuing struggle for membership and resources. The nature of public and private interests and the free-rider problem also bias the choice of activities groups undertake in pursuing their interests. Organizations with economic interests, such as automobile firms, will concentrate their lobbying efforts on those decisions that most directly affect them (e.g., specific decisions made by regulatory agencies), rather than on the broader legislative decisions setting priorities and choosing policies. In this way, firms' successful lobbying efforts are most likely to benefit the organizations doing the lobbying. In contrast, any benefits from lobbying in the legislative arena would likely accrue as well to those who have not directly invested in the political activity. A serious consequence of this response to the free-rider problem, however, is that the interests of the general, unorganized public are poorly represented at the important phase where regulation is authorized.

The biases inherent in interest group politics extend beyond this free-rider problem. Interest groups become concerned with advancing both the status of the organization and the careers of its leaders.[2] Howard Margolis has argued that much of the public's interest in clean air and the efforts to reduce automobile emissions, for instance, was not well served by the contests between the strong environmentalists and the automobile companies over the terms of the 1970 Clean Air Act.[3] The public would have been better served by the original proposal of a 90% emissions reduction effective in 1980 rather than 1975. The environmentalist organizations, however, motivated in part by their need for an absolute moralist position, argued that all

pollution was bad, and demanded an immediate end to polluting emissions. The automobile companies, who might have been expected to lobby for the delayed standards, had a more important interest to pursue, given the structure and strategy of the industry. According to Margolis, the primary concern of the American car companies was to preserve the primacy of the internal combustion engine over alternative technologies that would encourage new (possibly foreign) competition require substantial capital investment, render obsolete much of their current technology and physical capital, and threaten their control of the industry. The earlier deadline, particularly coupled with the pressure on the petroleum companies to market no-lead gasoline, fulfilled this interest. The companies could argue that there was no way to develop and introduce an alternative technology by 1975 and that attaching the catalytic converter, which they had earlier opposed, to the internal combustion engine was the only practical way to meet the standards by then. Furthermore, if the standards could subsequently be delayed one or two years at a time with weaker interim standards, there would be no pressure to adopt alternative technologies not controlled by the current industry. We need not agree with Margolis's specific conclusions to see that this is a situation where even many competing interest groups, each pursuing its own institutional objectives and strategies, does not necessarily result in representation of the whole range of public interests.

Currently, there is a trend toward even more specialized interest groups that focus on very specific interests and pursue them with increasing vigor. Very intense, single-issue public advocacy is quite apparent in many social areas such as abortion, gun control, or television advertising to children. General business lobbies, too, such as the Chamber of Commerce

and industry-wide trade associations, are being replaced by increased activity on behalf of individual firms. Much of this shift can be traced to the effects of regulation on the competitive structure of specific industries. The differential competitive effects of regulation pit firms and industries against each other, making industry-wide and private sector-wide political action less attractive.

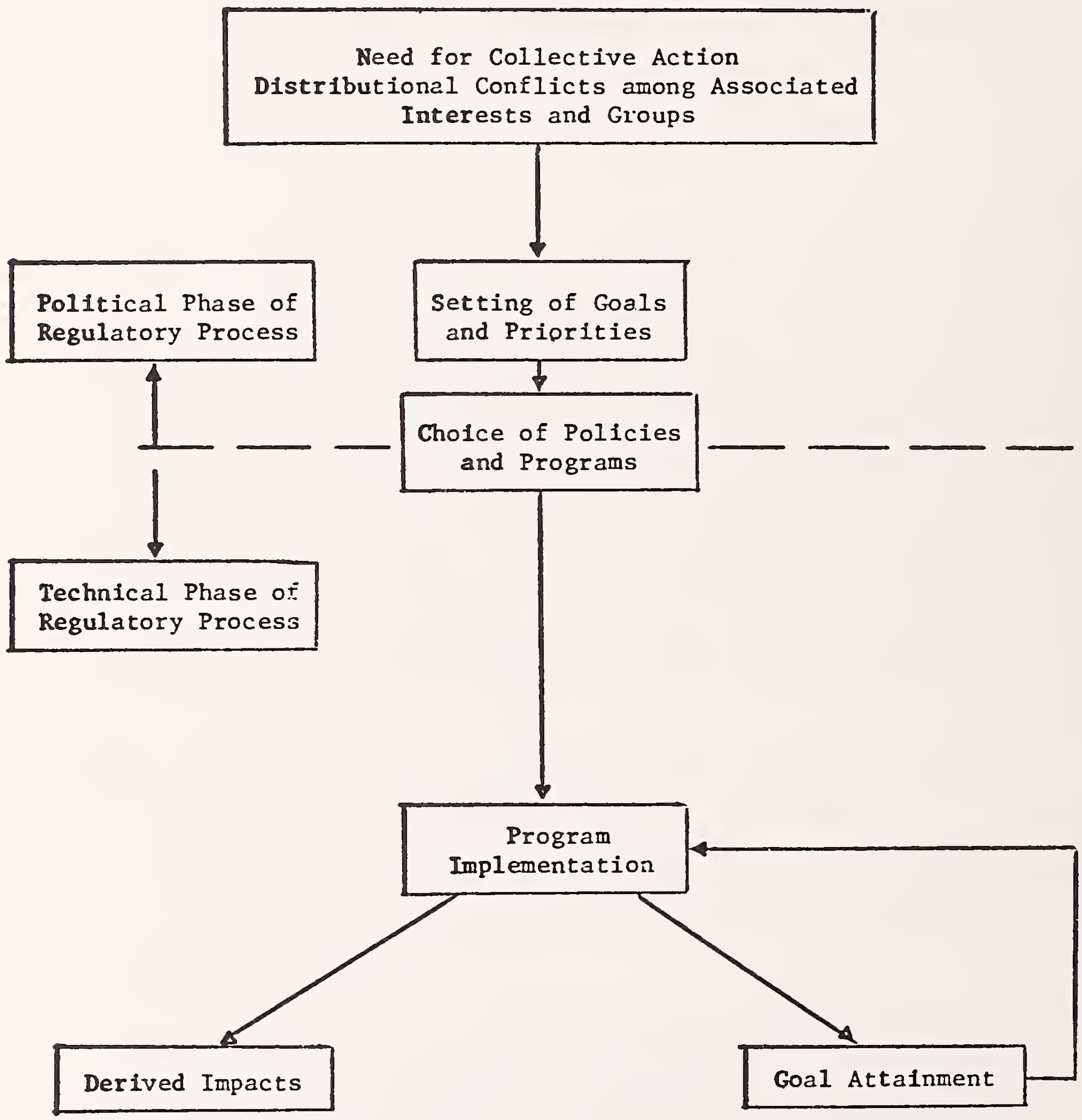
Establishing Priorities

The establishment of special priorities and the reconciliation of diverse interests are traditionally assigned to the "political" part of the regulatory process, the first two levels in Figure 1. In setting society's priorities among competing objectives, the legislature and executive respond to the public's various demands and interests. As we have seen, however, the competing private interests which collective action sets in motion may be formidable barriers to the making of sound public policy because some but not all of these interests will be articulated and promoted by various interest groups.

Elections, political parties, and the continuing competition among individuals and parties for public office constitute, in theory, another link from the public's interests to the setting of priorities. Thus the political process should dilute the role of particular interest groups. In heterogeneous constituencies, with officeholders elected on a one vote/person basis, politicians and parties must accommodate their behavior and positions to the distribution and intensity of individual preferences within the electorate. Hence, they build coalitions among voters, as evidenced by party platforms and balanced tickets, which should further blunt the effects of interest groups.

Figure 1

Simplified View of the Regulatory Process



This theory increasingly fails to describe reality, however. Congressional representatives are charged with running errands for constituents, spending time seeking media exposure for their own political advancement, and even using the power of office to enrich themselves, rather than focusing on policy making. Further, organizing and running a political campaign requires considerable resources - money and activists - that only organized interest groups can donate. Thus, elected politicians can be influenced by organized interests, both public and private, to an ever greater extent. Political parties could, in principle, counteract the financial and political influence of interest groups, but in fact the decay of party organizations and the weakening of the electorate's party ties are increasing the influence of interest groups.

Congress is responsible for the entire range of public policy issues and because of its electoral ties to small (especially in the House) or geographically differentiated constituencies, it is very sensitive to the distributive effects of policy and its implementation. The most important distributional concerns are those affecting local employment and economic activity, although there is evidence that representatives are influenced as well by broader constituent interests than economics.[4] The strength of the link between groups of constituents and their representatives is directly related to the importance of the issue within the district or state. Policy will therefore reflect the preferences of the constituencies most concerned about an issue, rather than a simple majority of the electorate or the interest groups within it.

The rise of autonomous congressional committee and subcommittee structures and the decline of the party organizations, both in the Congress

and among the electorate, have increased the influence of specific constituency interests, particularly economic ones. Thus, representatives from agricultural districts dominate the committees that make agricultural policies, and shape those policies to their constituents' interests. Recent reforms in the party structures and seniority rules are intended to strengthen the influence of the party leaders in these matters, but we have little evidence of their success. Currently, the influence of particular interests, as exerted through congressional elections and the committee structure, seems to dominate the interests of the unorganized public.

The President, too, has come to play a very important role in priority-setting. Although this role is most apparent in the budgetary process, presidential leadership and influence extend to all facets of the process. Most important legislation originates in the White House (although there are exceptions, such as the Clean Air Act of 1970) and Congress often needs prodding from the President to complete action on a bill.

The President relies on two very different constituencies than does either side of the Congress, however. One of these constituencies is electoral, the other bureaucratic. To be elected, or re-elected, the President must collect a majority of the votes in enough states to constitute a majority of the electoral college. Consequently, presidential candidates will be less sensitive to specific regional concerns and interests and more sensitive to how policies affect significant interests across several regions and many states. The President will be highly influenced by interest groups that are organized on a national scale and can either provide support in many states and localities or have ready access to national media sources - such as the AFL-CIO, Nader's organizations, much of the environmental movement,

and so forth. As with congressional elections, the decline of party organizations and weakened party identification among the electorate have left presidential candidates dependent upon interest groups for campaign resources and political influence.

The President's bureaucratic constituency is also very important. As head of the Executive Branch of the federal government, in preparing budgets and legislation, the President must weigh the narrowly focused interests of the many executive departments and agencies. And their interests may deviate substantially from those of the public.

Once regulatory goals or priorities have been set, the next problem is one of policy choice which is too often seen as a strictly technical or administrative matter. One aspect of it is, indeed, the technical analysis of alternative policy instruments and programs, such as predicting the effects of regulation versus effluent taxes or the selection of fleet-weighted rather than mimimum mileage standards. These analyses often include cost benefit, cost-effectiveness, or feasibility studies carried out by lawyers, engineers, and economists employed by the administrative agencies that will be charged with carrying out the chosen policy. Such technical analyses are intended to help Congress and the President to select the most "efficient" means to attain the goals they have set. Efficient, in this context, usually means incurring the least total cost for a given result.

The choice of an adequate policy instrument is extremely sensitive and difficult; and not often amenable to such an efficiency analysis. As a practical matter, the decision to adopt a fleet-weighted average rather than a minimum standard regulation may have little effect on the total costs of mileage regulation; but the effects on different car producers and consumers may be substantial. Domestic assemblers with a well-balanced product line will

be favored by fleet-weighted averages over those with a limited product line and buyers of gas-guzzlers will still get their cars, although at a substantially higher price. It is incomplete and misleading, therefore, to treat this as an administrative decision to be determined on narrow technical grounds, such as least aggregate cost or legal due process, ignoring the major political implications of these decisions. Politicians do not ignore them and, therefore, policy analysts cannot do so.

Implementation

In conventional theory, good implementation decisions can be based on rigorous analysis of the alternatives and their consequences. It is generally assumed that the major impediment to good decisions is the uncertainty of the outcome. Given this view of implementation, it is not surprising that the regulatory agencies' major strengths are typically their ability to obtain, organize, and use experts in the decision process.

Their assignment to concentrate on the technical and administrative (implementation) aspects of issues, their specialization of functions, and their reliance on expertise have important and predictable consequences for agency behavior. Agencies will tend to define objectives in prescriptive and narrow ways; to isolate problems and analyze alternatives only in terms of its single objective; and to assume that the political and economic world remains constant. This behavior precludes (1) effective consideration of conflicts with other policy objectives assigned to other agencies, (2) sensitivity to the derived effects of regulations which do not affect the agency's stated objective, and (3) any accommodation to the actions of other actors. Legitimate conflict about different policies becomes a bureaucratic conflict among competing agencies - for funds, people, and access within the Executive Branch. In such cases, the shrewdness, contacts, and institutional

expertise of individual agency administrators, rather than the broader public interest, may determine the outcome.

A common characteristic resulting from the agency's focus on a single outcome is the desire to shift any uncertainty associated with a policy and the attainment of the mandated objective to other actors and institutions, such as other agencies, private businesses, or the public. For example, the current automobile emissions program, whereby the EPA sets effluent levels and tests production models to ascertain whether they meet the standards, shifts the uncertainty with respect to achieving clean air onto the automobile manufacturers. Consider the manufacturers' costs if the test vehicles should fail, given that production of that model year's cars has already begun. By contrast, an effluent tax program would put the agency in a more uncertain position: it might end up a year with greater tax revenues and less pollution control than it anticipated.[5]

The more sophisticated implementation plans provide for the monitoring of results by the President and Congress to determine whether policy goals are being attained. In any event, congressional evaluations commonly entail hearings and investigations by the congressional committees responsible for oversight of the particular agency. Congress's legislative and budgetary authority can make the agencies particularly sensitive to the interests expressed by the committee members during oversight. This sensitivity can be harmful to the public's interest, however. The committee system in Congress creates the opportunity for special interests to exert a large influence on policy. The oversight function makes the agencies even more dependent upon these same committees, often on matters which never come to the attention of the full Congress, thus reinforcing agency sensitivity to specific constituency and interest groups' demands.

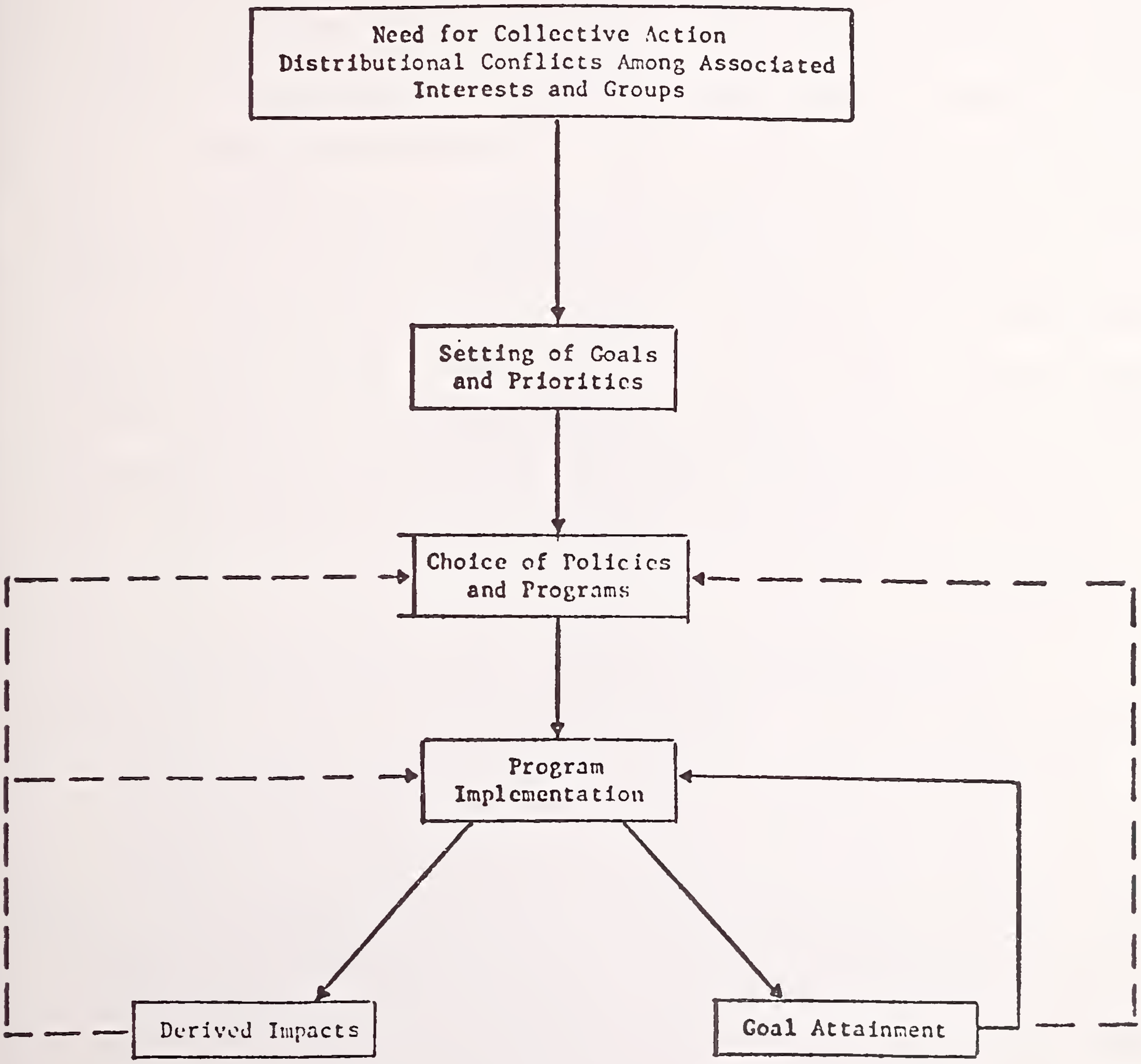
The main characteristic of the traditional view of the policy process just described and shown in Figure 2 is its hierarchical structure. What feedback exists in this model is the product of administrators. This model is inadequate and must be greatly expanded to be of help in understanding the regulatory process.

Economists and political scientists in the public policy field have made two important extensions of the model as shown by the dashed lines in Figure 2. The goals set by the political process may not be realized because the original choice of policies was in error, not because their implementation is faulty or underfunded. It also may be the case that new information and experience have caused politicians to reconsider the choice of policies and possibly to try new ones. The first addition, then, on the right side of the chart, shows the re-evaluation of the original choice of a policy instrument as part of the overall assessment of a policy's success.

The second extension is the explicit recognition, denoted on the left side of Figure 2, that policy implementation necessarily produces effects beyond those directly related to the policy goal. These derived or secondary effects may conflict with other social goals and are sure to be redistributive in that they create secondary benefits for some people and costs for others. Thus a supplier of seat belts benefits from their being required equipment; the producer of lead-based gasoline additives suffers when we require catalytic converters, which need unleaded gasoline; people in rural areas find they are paying for pollution control devices from which they receive little benefit; and required safety features add weight that inhibits achievement of mileage goals. These derived effects may equal or exceed the intended effects in magnitude and will always exist because of the interdependent nature of the politico-economic environment and the limitations of our

Figure 2

A More Sophisticated View of the Regulatory Process



policy instruments. The feedback links from "derived impacts" to "policy choice" and "implementation" represents these effects.

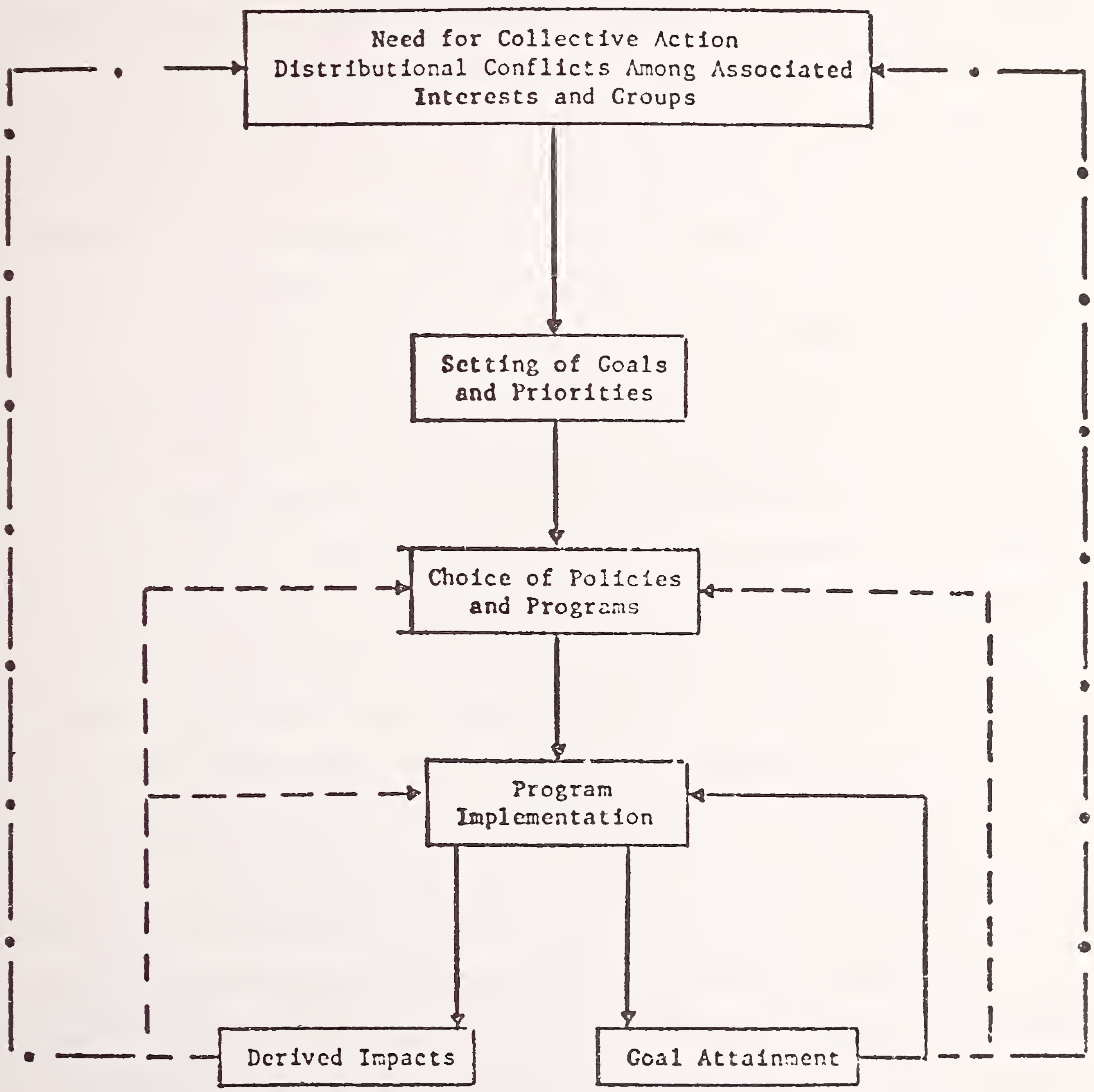
An Expanded Model of the Regulatory Process

One critical element is still missing from this more sophisticated model - recognition of the inseparability of the economic and political aspects of regulation. Both the goal-related and the derived impacts affect individual interests, their conflicts, and the process by which social priorities are set and policies selected. These feedback links to the political arena, represented by the dashed and dotted lines in Figure 3, arise for a variety of reasons. If the true costs of a program were originally underestimated, new information may cause society to alter its pursuit of certain outcomes. People may then set new priorities, not just adopt different methods for achieving the same ends. Similarly, a policy's potential conflicts with other priorities requires continual monitoring and may require adjustment of the priorities, not merely better coordination and administration of existing programs.

The nature of the regulatory process itself may create these important feedback effects: many of a program's derived impacts are determined by the administrative agency during implementation, and are thus not foreseeable during the initial debate over priorities. These derived impacts may not alter the total cost of the program, but may have substantial distributional consequences that will substantially change the constellation of political forces among the electorate. Individuals bearing an unanticipated burden will want to revise the policy, while those with decreased burdens or unanticipated gains may strongly support the policy.

Figure 3

An Expanded View of the Regulatory Process



Whatever agency is authorized to implement the program typically becomes a powerful advocate for its continuation. The policy's implementation may also create new interest groups to promote previously unorganized interests. In the extreme, the regulations may even eliminate previous interests and groups, for example, by driving marginal firms in an industry out of business, leaving the industry to a different set of firms, perhaps large oligopolists. Thus, the process of developing and implementing policy alters both the interests and the conflicts within society and the processes by which collective needs are translated into public action.

How various individuals, firms, and interests are affected by a policy, how these effects influence preferences and interests, and how they alter the political process require sophisticated political and managerial analyses. These analyses must focus on individual effects at the microlevel. Unfortunately, our limited technical capacities and our narrow conceptualization of the questions means that analysis typically concerns only aggregate costs and benefits, with little or no consideration given to the legitimate equity claims of affected individuals. Yet many decisions with negligible effects on total social costs and benefits have large distributional consequences that merit a public response and that may evoke significant political actions. To illustrate, in a recent analysis of the impact of water pollution regulations on the pulp and paper industry, we found that even slight alterations in the definitions of industry subcategories and in the compliance standards imposed on these subcategories resulted in substantial changes in firm net worth, the level of competition within the industry, and the regional distribution of economic activity.[6]

Clearly, these "technical" decisions affect competitors differentially, given the specific technology and competitive strategy that each firm already has in place. The EPA and other regulatory agencies often have very little capacity to respond to such concerns. Of course, the lack of capacity is sometimes presumed to be beneficial, since it can be a source of immunity from unseemly political pressure. As a practical matter, however, failing to provide a regulatory agency with the capacity to respond to a problem will not eliminate the problem.

A second attribute of the process we have described is that it is not static and instantaneous, but dynamic and evolutionary. The economic and political activities whereby participants continually learn about the technical and political consequences of regulation and, accordingly, develop options, refine goals, and influence public and private policy is an ongoing process. This characteristic is particularly true of regulatory policy which is derived from the continuing decisions of the administrative agency as it promulgates and enforces rules. These ongoing decisions, often hidden from public scrutiny, give affected parties ample opportunity to react to a policy and to change its direction.

The dynamic and evolutionary character of the regulatory process takes on greater significance when we consider that the mass public generally lacks a deep understanding of the issues and has only limited information about alternative policies. Even in currently debated nontechnical areas, the public may perceive public issues in only broad and symbolic terms, e.g., Clean Air Is Good. In areas that require sophisticated technical analyses, the public may be quite uninformed. This is not surprising, since many so-called experts cannot agree on the costs and effects of many of the programs

proposed, and many public officials and private sector managers, too, react to the symbolic rather than the substantive issues. Public debate is all too often superficial and rhetorical, therefore, doing little to mediate the legitimate conflicts created by regulatory strategies. The political institutions are expected to perform that function.

The importance of these dynamic properties is heightened by our inability to analyze and assess the full effect of proposed regulations and by certain institutional incentives and responsibilities. Specifically, Congress and the regulatory agencies have little incentive or need to consider the costs, even in the aggregate, of achieving a particular goal because the vast majority of the costs will be felt in the private market and do not require congressional appropriation. Nancy Dorfman estimates that only 25% of the costs of the environmental programs passed in the early seventies are borne by the public sector, and even that includes state and local costs.[7] If Congress had to pass tax increases to cover the private as well as the public costs of these, and similar programs, there would be a lot more public discussion of their magnitude and incidence, as well as better analysis of their effectiveness. In the environment, Congress often becomes more sensitive to the symbolic aspects of the issues prompting the regulations than to the real trade-offs required in implementing them. Neither they nor the public must bear the costs directly. Indeed, it might be difficult to explain to one's constituents a vote against a program the true costs of which are not readily perceived by the voters.

Finally, and most importantly, the full political process outlined in Figure 3 is interactive, not hierarchical. The interactions are inherently and legitimately political because they involve the weighing of different, conflicting interests among individuals and priorities. Actors in the

regulatory process may perform badly, not merely because of their analytical limitations nor because of their failure to see the dynamic and evolutionary aspects of regulation, but because they fail to perceive its interactive nature. One of the major consequences of this failure of perception is the widely held belief that it is possible and permissible to isolate "technical" questions from "policy" issues.[8] Technical issues often refer to efforts to identify and estimate the cost and possible consequences of proposed regulations: Will a given engineering modification meet certain emissions standards? What will the modification cost? Does the modification decrease gasoline mileage? Unfortunately, the simple distinction is impossible. All policy questions are both technical and political.

Consider the example of automobile emissions control. When Congress debated emissions standards for automobiles, they often bypassed complex technical questions because they were unresolvable. Indeed, despite obvious facts to the contrary, individual members of Congress repeatedly stated that technical issues were not germane to the debate. In a similar vein, political considerations are often thought to be less relevant when congressionally mandated policy is being administered rather than formulated. Particularly in the case of emissions control, where the EPA administrator was given explicit performance requirements, one might naively expect few political issues to arise in the course of administering the program. As a practical matter, however, the political dimensions of the various administrative decisions that confronted EPA often exceeded the environmental dimensions. The distinction between political and administrative decisions becomes even more obviously hopeless when we recall that many economic interests devote their lobbying activities to influencing the regulatory agencies' decisions rather than the legislative process.

Deciding which decisions are technical and which ones are political is a futile exercise. The important concerns for both public and private decision makers are the technical and political effects of each regulatory decision, the various political institutions' capacities to respond to these effects, and how we can capitalize on these capacities to improve public policy.

Toward More Effective Public Regulation

We have described a regulatory process that is interactive, dynamic, and very sensitive to micro-level impacts. These characteristics have important implications for the type of analysis required for effective regulation, the structure of public and private institutions, and the behavior and attitude of individual participants in the regulatory process.

It is painfully clear, at least to those of us with an academic bent, that if society is to progress toward more effective public regulation, analysts must develop and refine methods to capture and identify at a very disaggregated level those consequences of regulatory activity that have substantial distributional implications for individuals, firms, and regions of the country. Firms must assess the effects of regulation on their competitive positions, not just its effects on capital and operating costs. Public officials must identify the incidence of regulatory impacts and the resulting political pressures, not just aggregate costs and benefits. To do these analyses, we must increase the sophistication of our micro-level modeling capabilities. Such micro-level modeling is neither cheap nor easy, just necessary.[9]

The improved analyses we seek must also give greater prominence to the dynamic characteristics of the regulatory process. Static analyses based on the assumption of an instantaneous shift from one equilibrium to

another are simply inadequate for assessing the effects of a regulatory strategy. At present, however, the tools for disaggregated, dynamic analyses are not available; future research must provide them.

We have attempted to demonstrate that the impact of regulations cannot be divorced from the institutions that promulgate and implement them.[10] Accordingly, when we address the questions of risk and uncertainty associated with any program, we must also consider how specific institutions will respond to that risk. If we accept the premise that managers of organizations - whether public or private - want to reduce the uncertainty associated with their decisions, then we can see how important it is that different regulatory schemes lead to different patterns of exposure to risk. If a regulatory agency has considerable authority, for example, there is less risk of not achieving the performance objective but a greater probability of over-regulation and probably greater cost and uncertainty for producers and consumers. Conversely, leaving more discretion to firms, as in the case of design standards or effluent taxes, might lead to less regulation, but also increase both the risk of not achieving the performance objectives and the uncertainty confronting administrators. Explicit consideration of these risks and how organizations are likely to react to them should be a routine part of regulatory analysis.

Implicit in our call for these improvements in the analytic methods used to evaluate regulatory programs is our underlying belief that understanding is the better part of wisdom. If we are to improve our institutional capacities for regulation, it is essential for each actor in the regulatory process to have a better understanding of that process. We wonder, for example, if the automobile industry had recognized that the public's demand

for safer, cleaner cars was both legitimate and likely to be fulfilled, and if they had clearly decided what their strategic competitive interests were, whether they could have avoided their current political problems by engaging in some form of political activity other than the stonewalling efforts characteristic of the 1960s. Similarly, we wonder whether, if policy makers had fully appreciated the fact that emission control efforts were not only "forcing technology," as was commonly recognized, but also forcing the competitive strategies of various auto producers, they would have acted differently.

The institutional improvements we see as desirable stem directly from the interactive and dynamic nature of the regulatory process. We reject as myth the idea of an independent, strictly professional and apolitical regulatory agency. On the contrary, we feel strongly that regulators are subject to the same political pressures as other federal executives. We similarly reject as myth the idea that there are strictly "policy" issues. Thus, the Congress must also accept its responsibilities for considering technical questions and develop the means for obtaining and processing the requisite analysis. This condition is not impossible to meet: the House Ways and Means and Senate Finance Committees address complicated tax matters in a technically and politically sophisticated manner. Finally, private firms and individuals must accept their role as participants in this political process and be willing to contribute their analysis and arguments about the explicit <u>public</u> conflicts of proposed policies and regulations and not confine their arguments to the "technical" issues.

One clear recognition of the adaptive, dynamic and political nature of the regulatory process would be to institutionalize continuous legislative review, oversight, and direction. Legislation, in our view, should not

mandate inflexible constraints on future actions, but should allow means for adapting future regulations and implementation schemes to experience. One model of this process might be the initial House version of the 1972 Amendments to the Federal Water Pollution Control Act. This proposal set out specific short-term goals and criteria for regulation (the 1977 standards), established longer-term objectives without mandating their implementation (the 1983 and 1985 goals), and created a study and review process to assist in appropriate mid-course corrections (the so-called Rockefeller Commission). We might contrast this proposal with the 1970 Clean Air Act. This legislation not only set very specific short- and long-term goals for air quality and auto emissions but also failed to provide an explicit mechanism to insure responsible mid-course corrections in policy. Instead, we have now delayed implementation of standards and must contend with strategies proposed and evaluated on an *ad hoc* basis. This approach has benefited neither producers, environmental interests, nor the public.

The program of monitoring and mid-course corrections we advocate differs from traditional oversight of administrative action in that all decisions and debate would come before the full Congress, follow the traditional legislative process, and go to the President for approval; oversight would not be left to individual committees or subcommittees whose decisions and influences may be confined to a narrow set of interests. Such participatory monitoring of regulation by Congress and the President would create an explicit, adaptive and dynamic political process, reflective of the feedback links shown in Figure 3. Note that this proposal differs sharply from the currently popular concept of "sunset" laws. Such laws mandate only

periodic reviews of an agency's existence and, consequently, neglect the more nearly continuous evaluation and adjustment of agency decisions that is essential to effective regulation.

Our final set of recommendations concerns the behavior and attitudes of the individual participants in the process. To say that both public and private actors must think and behave strategically perhaps restates the obvious - although we find little evidence of such efforts. For example, most business curricula contain numerous courses training the manager to think strategically about the economic environment, the behavior of consumers and competitive market forces. We find only fledgling - and sometimes token - efforts to teach strategic thinking about the political environment, the behavior of voters and interest groups, or the competitive implications of government action. Similarly, many programs for public managers give considerable attention to aggregate cost-benefit studies, decision theory, and ways to evaluate and implement given policies. Much less attention is paid to estimating the distributive effects of various policies and the political implications of those effects. If public and private actors will simply recognize the legitimately conflicting interests inherent in many public decisions, and understand the way in which institutions react to shape these interests and express their interests throughout the political structure, we will have advanced our capacity for good public regulation.

We have tried to argue that before they can develop adequate strategies, public and private managers must have better tools of analysis. Our studies suggest, however, that all actors in the regulatory process must also distinguish analysis from decision. Analysis, by itself, no matter how sophisticated, will rarely lead to a unique policy choice. Indeed, the most

analysis can ever be expected to do is establish the terms of trade among society's many conflicting objectives. Decision is an explicit statement of preferences, not a mechanistic extension of technical analysis.

All parties to the regulatory process must further distinguish decision from strategy. A policy decision is at least partly an expression of preferences. A policy strategy, by contrast, is a means of marshalling and organizing scarce organizational resources so that over time the cumulative effect of individual decisions will lead to the desired ends. Stated somewhat differently, the strategic choices we make today determine the incremental decisions that we will confront tomorrow. In the regulatory arena, strategy means a careful assessment of where individual actors wish to be when the world around them changes. These are discretionary choices; they are not dictated by markets, laws, or analytical investigations.

Footnotes

1. See Edith Stokey and Richard Zeckhauser, A Primer for Policy Analysis (New York: W.W. Norton & Co., 1978), Ch. 14, for a discussion of why these problems are collective in nature and require government intervention to remedy.
2. The incentives facing members of interest groups and the incentives facing the potential leaders of these organizations are different. The "policy entrepreneurs" who can successfully build such organizations stand to gain considerable private rewards for their efforts. These rewards need not (although they can) be monetary; they may take the form of public recognition and personal fame, the ability to influence public policy, and the chance for a variety of public offices.
3. Howard Margolis, "The Politics of Auto Emissions," The Public Interest, Fall, 1977, pp. 3-21.
4. Leone and Jackson, "The Political Economy of Federal Regulatory Activity," Harvard Business School Working Paper, 1978. See also Otto A. Davis and John E. Jackson, "Senate Defeat of the Family Assistance Plan," Public Policy.
5. We might illustrate one political problem with effluent taxes here. It seems unlikely that the recipients of the additional revenues will be the same people disadvantaged by the higher pollution levels. This distributional question is an important political matter often ignored by economists' studies.
6. R.A. Leone and J. Jackson, "The Political Economy of Federal Regulatory Activity," Harvard Business School Working Paper, 1978.

Footnotes (continued)

7. Nancy Dorfman with Arthur Snow, "Who Will Pay for Pollution Control? - The Distribution by Income of the Burden of the National Environmental Protection Program, 1972-1980," National Tax Journal, Vol. 28, No. 1 (March 1975), pp. 105-115.
8. See, e.g., David Potter's essay in this volume.
9. For example, a recent paper assessing the impacts of water pollution regulations on the paper industry presented a micro-economic model at the level of individual plants for this purpose. (Leone and Jackson, "The Political Economy of Federal Regulatory Activity," Harvard Business School Working Paper, 1978.
10. See John Dunlop, "New Approaches to Economic Policy," Regulation, January/February 1979, p. 14.

INTERNATIONAL COMPETITION IN THE WORLD AUTOMOTIVE INDUSTRY

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THE ECONOMIST INTELLIGENCE UNIT LTD.

The various factors influencing international competition in the world automotive industry are much more complex today than they were a decade ago. In the 1960s, market requirements were the main forces determining international competition, although changes were taking place which have become much more significant during the 1970s.

Worldwide Market Changes in the 1960s

During the 1960s, Japan became a major manufacturing center for vehicles, joining the existing well-established manufacturing blocs in North America and Western Europe. However, the characteristics of each manufacturing center were rather different.

Trends in North America

The North American industry had reached a mature state by the 1960s. However, the large, comfortable cars to meet domestic requirements had little appeal outside North America. Consequently, exports were minimal. Besides, General Motors and Ford had long since established plants in Western Europe to produce smaller cars to meet requirements there. These smaller cars were also exported in volume. Chrysler acquired Rootes in Great Britain and Simca in France and thus joined General Motors and Ford as a European car producer.

The Big 3 also invested in other countries which had established their own automotive industries. Examples include Australia, South Africa, Brazil, Argentina, and Mexico, where high protective barriers successfully kept imports out.

The North American automotive scene was therefore self-contained. Car ownership had virtually reached saturation level so that emphasis was placed on frequent model changes to sustain a high level of replacement sales. The domestic market was large enough to support the necessary expenditure by General Motors and Ford on frequent tooling for new models. Chrysler, however, the smallest of the Big 3, sometimes found it difficult to finance new investment. American Motors, the fourth largest producer, operated on a much lower level and tended to pioneer new trends, particularly for smaller cars.

Imported small cars, initially from Western Europe but then also increasingly from Japan threatened the domestic U.S. market. New registrations of imported cars reached 1 million units in the United States in 1969. The buying public initially regarded an imported car as novelty. In a short time, they became aware of the advantages of small cars in their own right. Domestic producers tried to counter the challenge by captive imports and the production of sub-compacts, but through the 1960s the mainstream requirement in North America continued to be for large comfortable cars.

Western Europe

In Western Europe, the main development in the 1960s was the rationalization of the industries in the main producing countries. Various mergers in Britain resulted, finally, in the establishment of British Leyland in 1968. In France, Panhard was absorbed by Citroën. In Germany, Volkswagen acquired Audi and NSU; BMW took over Glas, and Borgward ceased production. A similar trend took place in the German truck industry. MAN acquired Bussing; Daimler-Benz bought Hanomag and Henschel from the Rheinstal Group. In Italy, Fiat acquired Autobianchi and Lancia.

The barriers between West European countries were gradually dismantled with the establishment of the European Common Market. This was beginning to encourage arrangements across frontiers although the exclusion of Britain from the European Common Market did much to discourage these developments in the 1960s. Nevertheless, automotive companies began to realize the advantages of pan-European organizations. Ford was an important leader in this development with the establishment of Ford Europe in 1967. This was a logical progression from the decision taken by Ford in 1960 when it bought out the 45 per cent minority shareholders' interests in Ford UK. The reason given by Ford at that time was to "obtain greater operational flexibility and enable us better to co-ordinate our European and American manufacturing facilities and integrate further our product lines and operations on a worldwide basis." Viewed in retrospect, this was a very important step in the internationalization of the automotive industry which set the pattern for other companies to follow.

Ford Europe has proved to be a highly successful venture. The European planning and sourcing concept for automotive component and material procurement could be fully developed once Britain entered the European Common Market in 1973. Ford now regards all Europe as one market and plans its investments, manufacturing facilities, and marketing on this basis. It has major automobile investments in the UK, Germany, Belgium and, more recently, in Spain. This gives Ford extensive flexibility in sourcing. In fact, Ford is currently the largest importer of cars in the United Kingdom. However, to the average British motorist a Ford is seen as a British product; few question where it was ultimately assembled.

Fiat also tried to establish the pan-European approach in the late 1960s by obtaining 15 per cent of Citroën. They might have succeeded had General de Gaulle not vetoed the Italian company's attempt to gain control. It did increase its holding to 49 per cent in the early 1970s, but finally divested itself of the holding. In 1974, heavy losses by Citroën led the French government to sponsor a takeover of its car operations by Peugeot.

The Emerging Japanese Industry

Japan expanded its vehicle production very rapidly in the 1960s. Japanese car production increased from 165,000 units in 1960 to 3,179,000 in 1970. The domestic market was certainly unable to absorb the rapid expansion of the industry and the Japanese producers began a very active campaign to develop export markets. Japanese car exports increased from a mere 7,000 units in 1960 to 725,000 in 1970. The Ministry for International Trade and Industry also promoted a rationalization of the industry. Nissan took over Prince Motors and Fuji; the Mitsubishi companies formed one group; and the Toyota group included Daihatsu Motor and Hino.

While rapidly expanding exports, Japan also protected its own domestic market by various open and hidden controls. Japan liberalized its investment code in the early 1970s which allowed American producers to seek links with Japanese producers through investment rather than trade. Chrysler was permitted to take a 35 per cent interest in Mitsubishi in 1971; General Motors took a financial interest in Isuzu. Ford also discussed investment in Toyo Kogyo, but the deal fell through and culminated only in a technical and cooperation agreement. These agreements assisted the smaller Japanese producers, enabling them to develop new markets, particularly in the United States. Although the American automobile producers have benefited from the investments, it has

certainly not provided increased sales in Japan of either Northern American or European vehicles produced by the Big 3 US automobile producers.

Countries in other areas of the world continued to establish or expand their own automotive industries during the 1960s. Opportunities for exports from Europe thus diminished rapidly, slowing down the growth of the European producers. At the same time, the Japanese were providing increasingly severe competition to European exports. Consequently, the indigenous continental European producers established plants in developing countries to protect their market position. They were also willing to sell their technology to Eastern Europe.

The American-owned producers were less willing to establish investments. Perhaps because earlier investments in South America had not provided the return they had anticipated because of economic and political instability. The Japanese attitude to investment overseas in the 1960s was increasingly governed by the belief that it was necessary if there was no other way of rapidly penetrating a new market.

The trends described above continued into the early 1970s. Then the world automotive industry experienced the traumatic effects of the oil crisis. The impact on revenue was sudden and dramatic as sales fell. This effect was relatively short lived. By 1977, world output of vehicles had more than recovered the pre-oil crisis level of 1973. The impact on costs was more damaging and long-lasting. Inflated costs severely affected manufacturers' ability to make provision for adequate investment. In addition to investment for commercial needs, the manufacturers have been faced with government pressures to invest in designing vehicles to conserve fuel. The pressures have varied from country to country with, of course, the greatest pressure taking place in the United States.

Government Policy as an Emerging Factor in the 1970s

Government intervention of this sort is now the primary influence on the development of the leading automotive industries of the world. The various policies of governments in different countries have profound impact on international competition. These policies are also encouraging the leading automobile manufacturers to develop strategies which maximize the opportunities and minimize the threats of government action in various markets.

In a recent published study by The Economist Intelligence Unit[1], the role of government was analyzed in the following way:

The USA: Government as Legislator

Western Europe: Government as Owner

Japan: Government as Promoter

Developing Countries: Government as Initiator

These policies are having a number of predictable effects on international competition but are also resulting in changes which perhaps legislators did not foresee.

The U.S. Automobile Industry

The United States Government's policy as a legislator is well defined. The initial emphasis was towards an improved environment through emission and noise controls, greater safety, and improved product quality. Since the oil crisis, the further factor of fuel conservation has been introduced by the legislators. The first three factors did little to alter the concept of the typical American car except to increase prices to meet the costs of the various legislative requirements. The intention of the various requirements was not to restrict imports although in practice they did so. Western European car producers have been faced with the dilemma of investing to conform with

United States requirements or to be excluded from the market. Some Western European manufacturers decided to invest; others have found it too costly to conform. Japanese manufacturers were not faced with the same dilemma because similar environmental and safety legislation was introduced in Japan.

Legislation concerning fuel conservation is likely to most seriously affect the competitive position of the United States automotive industry. Legislated fuel economy standards are forcing American automotive producers to redesign their product. The down sizing of cars, for example, brings American cars much closer to those designed in Western Europe and Japan.

The leading American car producers can call upon the vast experience they have gained in "small cars" technology as a result of their investments in Western Europe. General Motors and Ford are utilizing their experience to the full. The policy of the United States Government helps these two giant companies to move towards a world car design policy. What strategies they will adopt in the future to maximize the profit benefits arising from this trend to world-designed cars remains to be seen.

A transnational company can no longer make its decisions solely on the basis of market factors. In Western Europe, in particular, socio-political pressures are becoming increasingly important and these companies will certainly not wish to run down their existing large-scale investments in Western Europe. In developing countries, labor costs could be attractive for the assembly of small cars despite the absence of technical skills and a supporting industrial base. The possible interplay of such factors makes it impossible to speculate on the future policies of General Motors and Ford. However, the fuel conservation policies of the United States Government will certainly have a growing effect on the international investment and trading

patterns of General Motors and Ford. These policies will by no means be the only factors which these companies will take into account. Their future overall policies are likely to be directed towards maximum standardizaiton of product and increased flexibility in manufacturing facilities. The Ford Europe concept could be extended to the Ford World concept. Chrysler's decision, for financial reasons, to sell its European interests to Peugeot Citroën has severely weakened its opportunities for a future international marketing strategy. Chrysler now seems to be wholly committed to survival as an independent company in the United States. Its financial participation in Peugeot Citroën is unlikely to be of great benefit to Chrysler. It could, however, be of great assistance in enabling Peugeot Citroën to establish a significant market presence in the United States.

The legislative impact of fuel conservation is an important factor which is encouraging West European car manufacturers to seek greater involvement in the United States. The down sizing of cars provides the opportunities to quickly utilize existing small car technology. However, other interrelated factors are influencing their decisions. Viewed from West European eyes, the United States market is the largest single automobile market in the world. Renault took the opportunity of close association with American Motors to ensure that it would have a good distribution system for its cars in the United States. Renault cars may be assembled at some American Motors plants. It also has the opportunity to market Jeeps through its strong distribution system in Europe and other countries. The decision of Renault could well have averted a US Government decision on whether it should embark upon the same policy as certain West European Governments in becoming an owner in the automotive industry in order to protect employment.

Volkswagen's policy to invest in the United States was also based upon the decision to maintain a strong presence in the United States market. A further factor was that international exchange movements have made German products increasingly expensive in the United States. The international exchange movements have also prompted several West German component manufacturers to invest in the United States.

British vehicle component manufacturers, who are much stronger than British vehicle producers are also beginning to invest in the United States but for different reasons. The weakness of the British motor industry has encouraged them to look for new markets. Investment in the United States is likely to provide a better rate of return than it does in the United Kingdom.

So far Japanese automotive producers have not invested in the United States, but increasingly they will be faced with the decision to do so if the yen continues to be such a strong currency.

Foreign companies are therefore taking decisions to invest in the United States because of the opportunities arising from down sizing of cars in the United States to meet fuel economy standards. The possibility of tariff protection may also be in their minds. The United States is a low tariff country. Provided that imported cars meet the same legislative requirements as domestically produced cars, there are no barriers to entry. In fact, small volume producers such as Rolls Royce are able to obtain dispensation from fuel economy standards. However, there are presently lobbying pressures for greater protection against imports. These pressures could grow with the continuing balance of trade deficit for the United States and the fact that imports are damaging other sectors of the United States industry. Legislative changes are bringing the design of American cars more

in line with cars produced in other world manufacturing centers. An upsurge in imports is not likely in the short term because international exchange rates are making imported cars increasingly expensive. However, economic pressures could lead to protection measures in the longer term future.

Government Policy in Europe

In Western Europe, recent government intervention in the automotive industry has been mainly in the field of employment protection. This has been particularly so since the impact of the oil crisis which severely damaged the profitability of many companies. In the United Kingdom, Government intervention has become crucial for the survival of an indigenous motor vehicle industry. The most important example was the takeover of ailing British Leyland into public ownership. Despite a massive injection of public investment and a rapid succession of senior management changes the company is still in a very difficult position. The present management is taking a very strong line on labor disputes. Whether this action will enable Leyland to make a recovery remains to be seen. Much ground has been lost in meeting international competition. However, the survival of the company is crucial to ensure the maintenance of employment in the Midlands in particular. It is possible that the only long-term solution is for the government to allow Leyland to associate with another automobile manufacturer. There is currently some speculation of a possible link with Renault. The possibility of a link with a Japanese manufacturer should also not be completely ruled out. Japanese companies are currently faced with decisions on how to ensure a long term presence in Europe. One remedy for the growing pressure in many countries against Japanese cars might be for Japanese producers to invest in Europe. What is

important in Britain is to ensure that investment in the British motor vehicle components industry is maintained for employment reasons and government policy should be directed towards this end.

In this context the decision by Chrysler to sell its European interests to Peugeot Citroën may not further this end. Although there are assurances that Chrysler manufacturing facilities will be maintained, it is difficult to see how the plant in Linwood Scotland can be made viable. Of more significance to the British economy is the fact that Peugeot Citroën is a highly vertically integrated car producer, and there is no guarantee of the continuing large scale use of some British made components. National considerations are still very strong. For example, Lucas has been obstructed from gaining complete control of a leading French producer of electrical automotive components by the French Government which has prevented Lucas from purchasing the financial interest in the company currently held by Bendix. The French Government preferred to see Ducellier as part of a French owned monopoly group of electrical automotive equipment producers. Another example was the ruling of the German cartel office which prevented GKN from acquiring a leading German automotive components producer, Fitchel & Sachs.

In France itself, Renault has been state controlled since the end of the Second World War. The French Government also assisted in the merger of Peugeot and Citroën after the oil crisis, and is, of course, supporting the acquisition of Chrysler's interests by Peugeot Citroën in France.

In Italy, Alfa Romeo is state controlled. In Holland, the Dutch Government agreed on a major funding of Volvo's troubled Dutch passenger car operation in early 1978, with the express intention of maintaining employment. Volvo itself is in the process of receiving government participation

though not from the Swedish Government. The Norwegian Government has agreed to take a 40 per cent shareholding in Volvo. By so doing it will utilize some of its North Sea oil revenues and also promote some manufacturing of Volvo components in Norway. The Spanish Government has an interest in the largest car producer Seat, but against the current trend, it is seeking to sell its holding to Fiat.

Government control is not present in the German motor industry. However, the institutional banks play a strong role in German industrial investment. They actively intervened to prevent any further participation when Kuwait took a 15 per cent stake in Daimler Benz several years ago. Open intervention would be difficult because of fear of monopolies. However, it is interesting to note that the West German cartel office is not standing in the way of Volkswagen and MAN in their joint project to produce a new medium truck range.

Besides government intervention, the European automotive producers are also increasingly moving towards joint ventures to ensure an adequate basis for investment. Examples include the joint investment in small diesel engines by Societe Franco-Italiana de Motori (Sofim) in which Fiat, Alfa Romeo and Saviem (Renault) each has a third stake. Another example is FSM (Franco-Suedoise Moteurs) which is a joint company formed by Renault, Peugeot and Volvo to produce a V6, 2 1/2 litre petrol engine for cars made by the three companies. The pressures on costs are likely to see further joint ventures between European manufacturers. In August, Sr Agnelli of Fiat actively spoke of the need for greater West European co-operation in the automotive sector. Fiat itself is a strong advocate of a pan-European approach but Agnelli appeared to exclude the American-owned companies in

Western Europe from any participation. Its truck operation, IVECO, with facilities in Italy, Germany and France, is rapidly emerging as a challenger to Daimler Benz as the leading producer of trucks and buses in Europe.

However, national considerations are not always paramount in Europe. The EEC Commission has legislative functions and is taking the initiative in establishing common standards, type approval, etc. It could become a strong forum for initiating greater safety and environmental controls for the automotive industry in Western Europe. At present, however, this is unlikely as its directives are often based upon the report of working parties on which automotive companies are well represented. The EEC Commission is taking greater interest in consumer protection and could have a substantial influence in this area in the future.

Japanese Government Policy

The main objectives of the Japanese motor industry have been to expand and export. A third objective could be said to be to keep the domestic market for themselves. In each of these three areas the Japanese Government plays a major role. The Japanese Government has actively promoted Japanese car exports. It has also been encouraged to expand through the industry's close relationship with the Japanese financial system and government's expansion policy. At the same time as giving active encouragement to exports, the Japanese Government has failed to open up its domestic market on a fair trade basis and its construction and use regulations, while benefiting Japan's environment and consumers, have in the past been implemented in a difficult and arbitrary manner for prospective importers. Recently the government and the industry have gone some way in clarifying the testing procedures for imported cars. However, despite these relaxations, imported cars find it difficult to find a suitable distribution system in Japan. In 1977 car imports

totalled only 41,500 units out of a 2 1/2 million market.

Market pressures rather than government action are beginning to have a greater influence on the Japanese automotive industry. Exports are being affected by the strength of the yen. This influence could prove to be a much more important factor in influencing the strategy of the Japanese motor industry in the future. The possibility of Japanese investment in the United States is strong in the near future with Toyota, Nissan and Honda already looking for sites. Joint ventures in Europe are also a strong possibility.

The Economist[2] predicted in a recent article that "the cheap imported Japanese car is dead. A revolution is under way at Japanese car companies. By the mid-1980s Japan's car makers will be out of high volume, low margin exports and into lower volume higher profit models. Parts of the Japanese motor industry will be dismantled and shifted abroad, where labor costs (even in America) are now lower." The arguments are convincing, but if the prediction is correct it will cause a large scale employment problem in Japan.

New Motor Industries in Developing Countries

More and more countries in the world are seeking their own motor industries. The reasons given are to save on imports or to expand their industrial base, but often political pride rather than economic necessity is the main reason. It is relatively easy for government to encourage local assembly; it is often difficult to make the transition to local manufacture because of the lack of a strong supporting industrial infrastructure. To publicize investment in forging and foundry capacity is much less glamorous than to announce the establishment of a motor vehicle plant. In the past, a number of countries have permitted the establishment of too many assembly plants for the size of the domestic market with no hope of exporting the surplus. Increasingly governments are planning their industries more carefully.

Potential investors are also more carefully evaluating the viability of projects and their long term implications.

Nearly all new production facilities are dependent on the technology of the established manufacturers in North America, Western Europe or Japan. Although the development of new vehicle industries may be based on political decisions, they nevertheless have an effect on the established manufacturers. First, the potential for exporting is, in general, reduced although companies which do decide to invest often secure a short term advantage by exporting knocked down kits, assemblies and components. Second, the manufacturers' own home markets (and possibly some of their export markets) are potential selling areas for the new industries. A very good example is that Fiat technology helped to build up the Polish and Russian car industries and now Polish and Russian cars of Fiat design are being exported back to Western Europe.

Conclusion

From this wide-ranging review of various trends occurring in the world automotive industry several conclusions can be drawn:

1. Government intervention in various forms is playing an increasing role in influencing the pattern of international competition.
2. With the exception of the United States, government intervention tries to aid its domestic motor industry by protecting employment or encouraging investment or both.
3. The United States Government policy is to implement legislation to protect the motorist and conserve energy. This does not necessarily help its automotive industry.

4. All the leading automotive producers, whether they are American, West European or Japanese have increasingly to evaluate the various economic and political factors in their marketing strategies. These decisions are likely to be increasingly directed towards investment rather than trade.

Two important questions grow out of this discussion:

1. Will the United States Government be able to continue to pursue its legislative policies without feeling the need to resort to some form of protection for its automotive industry?
2. Will other governments seriously implement similar measures to those being taken by the United States Government on environmental control, safety and fuel conservation? With limited resources some of their vehicle producers would find it difficult to comply and still have sufficient funds for commercial survival.

Summary

The automobile in the United States, in Britain or in other producing countries can no longer be analyzed, managed, or regulated in terms of competitive forces within the traditional national markets. The industry, and its competitive domain now extend worldwide and increasingly its developments in national markets is being shaped by pressures being brought to bear by the actions of governments in the major producing countries. No single government can act independently today and be free of serious international consequences for domestic economic development and employment.

Footnotes

1. Worldwide Automotive Activity 1977 and Outlook 1978/79 - EIU Special Report.
2. *Economist* - September 23, 1978.

AUTOMOBILE EMISSIONS CONTROL POLICY - SUCCESS STORY OR WRONGHEADED REGULATION?

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"They [the Federal Government] can close the plants, put someone in jail - maybe me - but we're going to make [1978] cars to 1977 standards." - E. M. Estes, President of General Motors, quoted in The New York Times, October 5, 1976, p. 24.

Introduction

In Washington circles, automobile emissions control policy is considered one of the success stories in the environmental and safety regulation areas. If this is a success story, the other areas are surely in deep trouble. Any policy that causes the president of the largest manufacturing corporation in the country to issue a statement like the one above must be considered suspect.

Programs that encourage confrontation, bluffing, delay, collusion, poor design, inefficiency, and inequities cannot be considered good policy. Yet that is what our current policy of setting emissions standards and of direct "forcing" of technological improvements in emissions reduction has achieved. The alternative to present policies need not be one of simply allowing uncontrolled automobile emissions. There are superior policies

available - notably those centered on effluent fees as a means of discouraging polluting behavior and encouraging research on emissions reduction technology.

Accordingly, this paper will not dwell at length on specific levels of emissions reduction or on the costs and benefits of those levels. There have been an adequate number of studies that have done that.[1] We will focus here instead on the broader issues of shaping policies designed to achieve emissions reduction. We will argue that current policies have all of the undesirable properties mentioned in the previous paragraph. And we will argue that a program of effluent fees would eliminate most, if not all, of these undesirable characteristics. An effluent fee program would bring to bear all of the favorable properties of the price system - a system that the automobile companies usually espouse but for which they have shown little enthusiasm in the emissions area.

I. Current Policies and Their Philosophy

The analytical essence of the air pollution problem has by now been absorbed by most individuals concerned with pollution control policy. Air pollution constitutes a classic case of (in economists' terms) a negative externality. Individuals, as a by-product of their other activities (e.g., driving their cars), are emitting harmful pollutants that cause uncompensated damages to others. Property rights in air are ill-defined, so that, absent some kind of government program, there is no mechanism for adversely affected individuals privately to sue or otherwise collect their damages from the polluters. And, in the case of motor vehicles, even if the property rights were well-defined, the problems and costs of private detection and enforcement might still make private action impractical.

With the major costs of the action borne by others and not directly by the polluter, we cannot expect individuals in a society motivated largely by personal benefit considerations to take pollution reduction actions voluntarily. Pollution reduction activities carry costs for the individual undertaking them, while the benefits will be enjoyed primarily by others. Further, in the case of air pollution, the apparent reduction in pollution from any individual's single effort may be so small as to discourage even those whose feelings of altruism might otherwise spur them to reduction efforts. Similarly, in a society in which companies are largely motivated by the pursuit of profit, we cannot expect these companies voluntarily to provide pollution reduction devices on automobiles. The devices are costly; the extra costs will have to be reflected in higher prices for the automobiles; and nonaltruistic customers will instead choose to buy automobiles without devices at lower prices.

Accordingly, some kind of government program is necessary to induce individuals and companies to take actions that they would not take voluntarily to reduce emissions. The method chosen has been that of setting specific standards for emissions of specific pollutants from automobiles. At the federal level, these standards have been focused entirely on new automobiles. A few states and local communities have also set standards for automobiles in use, but they are the exceptions rather than the rule.

The Federal Government first became involved in setting standards for automobiles in 1965, with the passage of the amendments to the Clean Air Act.[2] The Secretary of HEW set specific emission exhaust standards for hydrocarbons (HC) and carbon monoxide (CO) for 1968; in subsequent years the Secretary of HEW and later the Administrator of the Environmental Protection

Agency (EPA) set more stringent standards for HC and CO, established nitrogen oxide (NO_X) standards, and set separate standards for evaporative emissions from gas tanks and carburetors.

The original standards were well within the technological capabilities of the automobile companies. In 1970, however, Congress decided to "get tough" with the automobile companies and to "force" the pace of technological improvement in emissions reduction. Congress mandated that by 1975 emissions of HC and CO from new cars should be reduced by 90% from their 1970 levels and that by 1976 emissions of NO_X should be reduced by 90% from their 1971 levels. Further, new cars were required to meet these standards for their first 5 years or 50,000 miles of use, whichever comes first.

In subsequent years, the EPA and the Congress delayed the imposition of these stringent standards at various times. The latest delay, granted in the 1977 Amendments to the Clean Air Act, imposes the 90% reduction in HC in the 1980 model year, the 90% reduction in CO in the 1981 model year, and the 90% reduction in NO_X in the 1983 model year. Table 1 provides a summary of the applicable exhaust emission standards and qualifications thereto.[3]

Note that these standards have been promulgated in the form of "meet the standard or else. . . ," where the "or else" has been a civil penalty of up to $10,000 per car sold and thus has been an implicit threat to close down any company in violation.

Why has the policy of setting standards for new cars been chosen over possible alternative policies? Primarily, I believe, because it provides the <u>appearance</u> of certainty. Congress and EPA command; the auto companies will obey. Further, the Congress has always had the attitude that the automotive pollution problem was solely the responsibility of the automobile companies; it was their responsibility to remedy it. And there has been a

Table 1

Federal Exhaust Emissions Standards (grams/mile)[a]

	HC	CO	NO_x
Uncontrolled car	8.7	87.0	4.0
1968-69	5.9	50.8	-
1970-71	3.9	33.3	-
1972	3.0	28.0	-
1973	3.0	28.0	3.1
1975-76[b]	1.5	15.0	3.1
1977-79[b]	1.5	15.0	2.0
1980[c]	0.41[d]	7.0	2.0
1981-82[c]	0.41	3.4[d]	1.0[e]
1983[c]	0.41	3.4	0.4[f,g]

[a] As measured by the federal constant-volume sampling, cold- and hot-start test.

[b] Interim standards established in 1973 and subsequent years.

[c] Level established by 1977 Amendments to the Clean Air Act.

[d] Original 1975 requirements of the 1970 Amendments to the Clean Air Act.

[e] Subject to waiver for diesel automobiles and the products of small manufacturers.

[f] Original 1976 requirements of the 1970 Amendments to the Clean Air Act.

[g] To be established only if the EPA determines that the public health requires it; otherwise, the standard is 1.0.

general belief at all levels of government that the pollution problem was purely a technological problem and that, if pressured hard enough, the companies would develop the proper technological solution.[4] This has, no doubt, been encouraged by the general American belief in the technological prowess of American industry.

In a world of well-known, well-developed, not-too-costly, and non-deteriorating emissions control technology, the presumption of certainty, of a completely predictable (and completely conforming) response by the automobile companies, is probably a valid one. But, at least since the passage of the 1970 Amendments to the Clean Air Act, we have been in a world of unknown, uncertain, and unpredictable technology. (We will argue below that this was also the case before 1965.) And in this world, the certainty of conformity promised by a policy of standards becomes a chimera. A policy of forcing technological improvements through the setting of possibly unattainable standards may instead, ironically, delay those technological improvements. Further, the emphasis on standards for new cars has meant that other ways of controlling automotive emissions have been neglected, and excessively costly and inequitable policies have been followed.

II. The Failings of the Standards Program

Perverse Incentives

In a world in which the technology of emissions reduction is uncertain and yet to be made practicable, a policy of setting standards has some obvious, perverse incentives for the development of that technology. Technologies that might be lower in cost but fail to meet the standards will be

ignored. Technologies that might offer greater reductions than the standards require, at relatively modest marginal costs, will also be ignored. If there are standards for multiple pollutants, technologies that might be especially good (and inexpensive) at meeting the standards for some pollutants will nevertheless be ignored if they cannot meet the standards for other pollutants. This has been an obvious problem for the development of diesel-powered automobiles for the American market; it is relatively easier to achieve low HC and CO emissions, but relatively more difficult to control NO_X emissions, with a diesel. The only incentive to develop technologies that fail to meet standards would be to influence future policy - revisions of standards. But this is an indirect incentive indeed.

Further, if a company takes the "or else" threat of closure seriously, it will focus on technologies with big probabilities of success, even if they are high cost. Lower cost technologies with greater uncertainties will be ignored, even if, on an expected value basis, they are a superior alternative.

But the question of whether the company genuinely believes the "or else" sanction needs to be examined more thoroughly. Consider the quotation at the beginning of this paper again. Did Mr. Estes genuinely believe that the General Motors' plants might be closed or that he would be put in jail? Clearly, the federal government is not going to close down large companies. Hence, a large company faces mixed incentives. If it decides to make an all-out, costly effort to develop the technology to meet the standards - and succeeds - it will achieve public relations benefits, curry favor with the policy makers, and perhaps earn some royalties from licensing its technology to other companies. But, of course, success is not completely assured. If, on the other hand, it delays, drags its feet, and reports that the technology

is simply not available, while maintaining enough of a research effort so that it can claim to the EPA, courts, Congress, and/or the public that it has made a good faith effort, it will not be shut down when it fails to meet the standards; instead, it will be given delays in the enforcement date of the standards.

Thus, the standards approach provides an incentive for "brinkmanship" behavior on the part of large companies. If a company actually gets to the brink, it can be fairly confident that the federal government will blink first.

Further, the standards approach encourages collusion among the companies. Though the incentives facing the individual company might lead it to make an all-out effort, it is clear that the incentives for the industry *jointly* are to delay. To the extent that the industry presents a united front and says that the technology is not available, brinkmanship becomes yet easier, delays in standards enforcement become yet more certain, public relations advantages become yet greater. The policy makers and the public are dependent to a great extent on the companies to inform them as to the state of technology and its feasibility. In the end, it is the companies that have to build the cars; in the end it is they who can say, "We simply cannot do it." Delaying the development of emissions control technology and delaying the reporting of information about that technology are clearly in the industry's joint interests.

A History of Delay

The discussion to this point has largely been of a theoretical nature. Let us now examine the history of the automotive emissions control effort to see how these incentives have, in fact, operated.[5]

After A.J. Haagen-Smit's research of the late 1940s and early 1950s had uncovered the basic process creating photochemical smog and had strongly indicated that motor vehicles were an important contributor to the problem, the automobile manufacturers formed a joint committee to study the problem in December 1953; in mid-1955 they signed a cross-licensing agreement ensuring that all manufacturers had royalty-free access to the emissions control technology developed by any other manufacturer. Though this agreement may have facilitated the exchange of new knowledge once that knowledge was created, it simultaneously dulled the incentives for each company to pursue research so as to gain a technological lead on its rivals. In January 1969, the Department of Justice brought an antitrust suit against the companies, claiming that the cross-licensing agreement was part of a pattern of collusion among the companies to delay the development and introduction of emission control technology.[6] In September 1969, the suit was settled, without an admission of guilt by the companies, by a consent decree that included the dissolution of the cross-licensing agreement.

Through the 1950s officials from the Los Angeles city and county, and California state governments prodded the automobile companies to do something about the pollution problem. The companies responded by saying that pollution was a complex problem that needed more research. And the research proceeded slowly.

Finally, in 1959, blow-by was "discovered" as a major source of emissions. Since the blow-by port had been specifically designed to vent engine emissions from the crankcase, since the technology to control these emissions had been known since the 1930s and had been installed on some commercial and industrial vehicles in the 1940s,[7] and since any untutored observer could peer under a running engine and observe the blow-by fumes

escaping, it is a wonder that this discovery took so long. In any event, the automobile companies voluntarily installed blow-by emission controls on all cars sold in California in 1961 (subsequent California legislation made it mandatory) and on all cars sold nationwide in 1963.

In 1962-63, rebounding from a period of financially lean times, Chrysler took a number of aggressive actions in the automobile market. It greatly extended new car warranties on drive train components to 5 years or 50,000 miles, whichever came first (the standard warranty at the time was 12 months/12,000 miles); it aggressively entered the fleet sales market, slashing fleet prices considerably; and, most important for our purposes, it aggressively touted some modest advances in emissions control technology and convinced Los Angeles officials that they should make some fleet purchases for demonstration purposes. Chrysler received intense automobile industry criticism for this last action.[8]

In 1963, the California legislature, tiring of the automobile companies' expressions of good intentions and absence of rapid progress, passed legislation requiring that exhaust control devices be installed on new cars when two such devices had been certified by the state. This opened the field to parts manufacturers, who did not share the automobile companies' interests in delay. In March 1964, the automobile companies told the state that the 1967 model year was the earliest that exhaust control devices could possibly be installed on new cars. In June 1964, the state certified four devices (all made by independent parts manufacturers), thus making exhaust controls mandatory on the 1966 model cars. In August 1964 the companies announced that they would, after all, be able to install exhaust control devices (of their own manufacture) on the 1966 model cars.

In the spring of 1972 the Ford Motor Company told the EPA that its personnel had improperly maintained the sample 1973 model cars that were being tested so as to be certified to meet the 1973 standards. Ford was required to begin the certification process anew but was allowed to ship cars to its dealers (but not to sell them to the public) before certification was completed. There was little question that EPA was not prepared to shut down the Ford Motor Company.

Also in 1972 the automobile companies first asked the EPA for a one year's delay in the 1975 standards established by the 1970 Clean Air Act Amendments. The EPA denied the request, the companies appealed to the courts, and the question was remanded to the EPA for reconsideration. This time, in April 1973, the EPA granted a year's delay. An important consideration in Administrator William Ruckelshaus's decision was his finding that Chrysler was completely unable to meet the 1975 standards. Its expenditures on emissions control were between a sixth and a tenth of the absolute amounts spent by Ford and General Motors and were a third as much per sales dollar. It had switched catalyst suppliers in September 1972, which apparently delayed its emissions control program by six months. Ruckelshaus devoted four pages of his decision, plus a six-page appendix, to Chrysler's efforts. He all but accused Chrysler of bad faith and of deliberately dragging its feet and delaying its emissions control program. But, in the end, he was not prepared to shut down Chrysler, and he granted the delay.[9]

By the end of 1974, after receiving two delays (one from the EPA in 1973, one from the Congress in mid-1974) of a year each, the companies apparently concluded that the original standards, at that time scheduled for 1977 and 1978, were simply not achievable and slackened their research efforts.

This was noticed by an EPA report in February 1975[10] and a National Academy of Science report in June 1975.[11] The companies promptly received another year's delay in the HC and CO standards in April 1975, this time because of a fear of sulfuric acid emissions from catalysts.

By the fall of 1976 it had become clear to all that the automobile companies were not prepared to meet the original stiff emissions standards, then scheduled for the 1978 model year. Indeed, the companies already had prototype 1978 models on test tracks, beginning the emissions certification process for the 1978 model year, with the sure knowledge that they would fail the 1978 standards. Congress was expected to pass a new set of amendments to the Clean Air Act, delaying the emissions requirements yet again and getting the companies (or the EPA, depending on one's perspective) off the hook. But a filibuster in the Senate at the last minute prevented passage, and Congress adjourned without the legislation. It was this failure to pass new legislation that led to the statement by Mr. Estes that heads this paper.

Eventually, in August 1977, Congress did pass the necessary amendments to the Clean Air Act, establishing the new schedule of standards provided in Table 1. (In the interim, EPA had to give special permission to the companies to ship their 1978 models to their dealers but not sell them to the public.) But in early 1978, the Ford Motor Company, in its report to the EPA on the status of its emissions control program, expressed serious doubts as to its ability to meet the stringent standards now scheduled for the 1981 model year.[12] We may not have seen the end of delays in the imposition of the original 1975/76 standards.

In-Use Emissions

As currently formulated, the standards apply solely to the sale of new cars. Until the 1977 model year, the EPA only tested the prototype cars that the companies provided to it and inspected vehicle assembly lines to ensure that vehicles were being assembled in conformance with those that were certified. In the 1977 model year, the EPA began spot assembly line checks of individual vehicles, but General Motors has recently challenged in court EPA's right to carry out these spot checks.

With testing and enforcement occurring only at the certification level, automobile owners have no incentive to maintain their cars so as to achieve low emissions. Indeed, if they believe that tampering with the emissions control system may improve the performance of their car (e.g., gasoline mileage, power, drivability), they may well do so. Nothing in the various amendments to the Clean Air Act makes this illegal for individuals; only car dealers, service station personnel, and fleet owners are forbidden to tamper; but without any in-use inspection, even this is unenforceable. A 1975 EPA report provided evidence of significant tampering with emissions control systems. This evidence is reproduced in Table 2. Also, surveillance of in-use emissions (to be discussed below) has revealed that over 10% of a sample of owners of 1975 model cars that were not supposed to use leaded gasoline were nonetheless doing so, thus significantly raising HC and CO emissions.[13]

The incentives for motorists to tamper, to use leaded gasoline, and generally not to maintain their emissions control system are clearly present. What has this meant for actual emissions from vehicles in use? The EPA has conducted a series of emissions surveillance programs, in which cars in actual private use are tested and their emissions recorded.[14] These data have been

Table 2

Results of Antitampering Survey Conducted by EPA, as of 1975

Survey Area	% of Vehicles with Major Components of Emission Control System Removed	% of Vehicles with Missing Air/Fuel Limiter Caps*
Washington, D.C.	15	33
New Jersey	15	50
Cincinnati, Ohio	Not Available	17

*Suggests degradation of emission control through poorer control of air-fuel mixture.

Source: U. S. Environmental Protection Agency, Progress in the Implementation of Motor Vehicle Emission Standards Through June 1975, Washington, D.C.: USEPA, (1976) Table II-3, p. 14.

used by the EPA primarily as an input into local transportation control plans. (To determine the necessary severity of controls to achieve a particular goal, one has to know the pattern of actual emissions.) These data are reproduced in Tables 3, 4, and 5.

The tables reveal that average actual in-use emissions have frequently exceeded the federal standards by statistically significant amounts (at the 95% confidence level, using a two-tailed test). This has been true for every model year, in every testing period, for CO. It has been true for a number of years for HC. The problems appear to be especially serious for high altitude areas; average HC and CO emissions in Denver have never been below the federal standards and have usually been far above. Conformance with the standards does appear to be appreciably better for NO_X, however, as revealed in Table 5. The table also reveal a definite tendency for emission control to deteriorate with the age (and mileage) of the vehicle.

Another measure of in-use emissions is the percentage of cars in-use that would pass all of the appropriate federal standards. As can be seen in Table 6, at all times less than half of the sample in-use automobiles are capable of meeting all of the standards; in some years, none of the sample cars in Denver are capable of meeting all of the standards.

Preliminary tests on very low mileage 1977 model cars indicate a similar pattern for these vehicles, although the high altitude problems may have been resolved.[15]

<u>The Problem of Phasing</u>

An essential part of the standards program is that the standards have been phased in gradually. As revealed in Table 1, a set of standards usually apply unchanged for two years, after which one or more of the standards is

Table 3

Average In-Use Emissions of Hydrocarbons, grams/miles

Model Year	Federal Standards	In-Use Testing Year 1972[b]	1973[b]	1974[c]	1975[d]	1976[d]
1967 & earlier	--	8.74[e]	8.67[f]	8.65[g]	8.93[h]	8.85[i]
1967 & earlier (Denver)	—	10.16[e]	11.91[f]	9.87[g]	—	—
1968[a]	5.9	5.73	6.18	7.09	6.30	6.37
1968 (Denver)	5.9	7.35*	6.89	7.65*	--	--
1969[a]	5.9	5.25	4.83	6.30	5.98	5.77
1969 (Denver)	5.9	6.32	5.97	7.07*	—	—
1970[a]	3.9	3.77	4.89*	5.07*	5.34	5.78*
1970 (Denver)	3.9	6.72*	5.56*	6.56*	—	6.05*
1971[a]	3.9	3.07	3.94	4.22	5.21*	4.84*
1971 (Denver)	3.9	5.59*	5.19*	5.51*	—	6.91*
1972[a]	3.0		3.02	4.17*	4.23*	3.82*
1972 (Denver)	3.0		4.75*	5.40*	6.53*	5.65*
1973[a]	3.0			3.59*	3.33	3.65*
1973 (Denver)	3.0			4.54*	4.60*	4.71*
1974[a]	3.0			3.08	3.58*	3.97*
1974 (Denver)	3.0			4.19*	5.15*	4.64*
1975[a]	1.5				1.32	1.72
1975 (Denver)	1.5				2.22*	2.37*
1976[a]	1.5					1.34
1976 (Denver)	1.5					2.34*

*Significantly above the applicable Federal Standard at the 95% confidence level.
[a]All cities in sample except Denver.
[b]Chicago, Denver, Houston, St. Louis, and Washington, D.C.
[c]Denver, Detroit, Houson, Newark, and St. Louis.
[d]Chicago, Denver, Houston, Phoenix, St. Louis, and Washington, D.C.
[e]1957-1967 cars.
[f]1966-1967 cars.
[g]1967 cars.
[h]1965-1967 cars.
[i]1966-1967 cars.

Source: Rutherford (1977, Table 25, pp. 50-52); Berens and Hill (1976, Table 11, p. 42): Bernard et al (1975, pp. 41, 58, 60).

Table 4

Average In-Use Emissions of Carbon Monoxide, grams/mile

Model Year	Federal Standards	In-Use Testing Year 1972[b]	1973[b]	1974[c]	1975[d]	1976[d]
1967 & earlier[a]	--	86.5[e]	93.5[f]	108.3[g]	108.5[h]	110.1[i]
1967 & earlier (Denver)	--	126.9[e]	141.0[f]	146.1[g]	--	--
1968[a]	50.8	69.3*	64.6*	74.8*	82.6*	87.1*
1968 (Denver)	50.8	109.2*	101.4*	97.0*	--	--
1969[a]	50.8	60.0*	62.4*	67.7*	78.5*	70.0*
1969 (Denver)	50.8	76.4*	97.8*	104.6*	--	--
1970[a]	33.3	47.6*	53.2*	65.0*	63.9*	75.0*
1970 (Denver)	33.3	94.8*	87.5*	105.2*	--	85.4*
1971[a]	33.3	39.6*	51.1*	51.5*	52.7*	56.1*
1971 (Denver)	33.3	88.1*	80.3*	96.9*	--	94.4*
1972[a]	28.0		36.9*	56.7*	51.8*	50.6*
1972 (Denver)	28.0		80.4*	90.5*	84.5*	71.6*
1973[a]	28.0			47.0*	45.3*	49.1*
1973 (Denver)	28.0			84.7*	81.0*	82.8*
1974[a]	28.0			35.9*	41.8*	52.2*
1974 (Denver)	28.0			79.0*	83.7*	81.4*
1975[a]	15.0				22.9*	27.4*
1975 (Denver)	15.0				48.5*	47.9*
1976[a]	15.0					18.3*
1976 (Denver)	15.0					45.1*

Source and footnotes: See Table 3.

Table 5

Average In-Use Emissions of Nitrogen Oxides, grams/miles

Model Year	Federal Standards	In-Use Testing Year 1972[b]	1973[b]	1974[c]	1975[d]	1976[d]
1967 & earlier[a]	--	3.54[e]	3.34[f]	4.04[g]	2.89[h]	2.83[i]
1967 & earlier (Denver)	--	1.89[e]	2.03[f]	2.22[g]	--	--
1968[a]	--	4.44	4.32	5.21	3.60	3.49
1968 (Denver)	--	2.20	2.86	3.21	--	--
1969[a]	--	5.45	5.08	5.56	4.25	4.13
1969 (Denver)	--	2.59	2.93	3.76	--	--
1970[a]	--	5.15	4.35	4.95	3.66	3.50
1970 (Denver)	--	2.78	3.32	3.22	--	2.73
1971[a]	--	5.06	4.30	4.83	3.90	3.84
1971 (Denver)	--	3.05	2.74	3.18	--	2.58
1972[a]	--		4.55	4.80	4.03	4.03
1972 (Denver)	--		3.08	3.29	2.68	2.74
1973[a]	3.1			3.47*	3.01	2.97
1973 (Denver)	3.1			1.96	2.06	2.20
1974[a]	3.1			3.08	2.89	2.90
1974 (Denver)	3.1			1.81	1.85	2.03
1975[a]	3.1				2.44	2.59
1975 (Denver)	3.1				1.62	1.81
1976[a]	3.1					2.56
1976 (Denver)	3.1					1.82

Source and footnotes: See Table 3.

Table 6

Percentage of Cars In-Use that Would Pass All of the Appropriate Federal Standards

Model Years	In-Use Testing Year 1973[b]	1974[c]	1975[d]	1976[d]
1972[a]	39%	21%	24%	19%
1972 (Denver)	3	3	0	0
1973[a]		15	19	13
1973 (Denver)		3	0	11
1974[a]		42	22	14
1974 (Denver)		0	0	0
1975[a]			37	30
1975 (Denver)			6	4
1976[a]				47
1976 (Denver)				14

Footnotes: See Table 3.

Sources: J.A. Rutherford, Automobile Exhaust Emission Surveillance - Analysis of the FY 75 Program, Ann Arbor, Mich.: Emission Control Technology Division, Office of Mobile Source Air Pollution Control, Office of Air and Waste Management, USEPA, (1972), Tables 16, 22, pp. 41, 47); A.P. Berens and M. Hill, Automobile Exhaust Emission Surveillance - Analysis of the FY 1974 Program, Ann Arbor, Mich.: Emission Control Technology Division, Office of Mobile Source Air Pollution Control, Office of Air and Waste Management, USEPA, September 1976, Tables 18, 19, pp. 46, 47; J. Bernard, P. Donovan, and H. T. McAdams, Automobile Exhaust Emission Surveillance - Analysis of the FY 75 Program, Ann Arbor, Mich.: Certification and Surveillance Division, Office of Mobile Source Air Pollution Control, Office of Air and Waste Management, USEPA, 1975, pp. 8, 38-40); and M E. Williams, J. T. White, L. A. Platte, and C. J. Domke, Automobile Exhaust Emission Surveillance - Analysis of the FY Program, Ann Arbor, Mich.: Certification and Surveillance Division, Office of Mobile Source Air Pollution Control, Office of Air and Water Programs, USEPA, February 1974, p. 6.

tightened. This gradual phasing is intended to achieve some interim emissions reductions and to reassure the EPA and Congress that progress in emissions control is indeed being made. If a strict set of standards were simply mandatory, say, five years in the future, with no interim standards, the opportunities for brinkmanship by the companies would be yet greater.

But the price that must be paid for this gradualism is that the companies are denied the learning curve benefits (and possibly the full amortization of capital equipment) from a long experience with one set of standards. Costs are inevitably higher than they would be with longer periods of fixed standards.

Gradualism is normally considered good policy. Here we see the costly consequences of gradualism.

A Summary

Progress had defnitely occurred in emissions control technology. New model cars today emit fewer pollutants than did new model cars of a decade ago. But this progress has been slower than it need have been. It has been more costly than it need have been. The inflexibility of the standards approach discouraged the introduction of diesels and other alternative engines. The inflexibility of the standards in 1973 and 1974 alone probably meant $7 billion in excess costs.[16] Cars in use have generally not been attaining the certification standards. And more delays in attainment of strict standards are on the horizon.

These findings must be ascribed to the standards approach. This approach has not brought the certainty of attainment and enforcement that it is supposed to bring. Instead, it has brought delay and evasion.

III. Inspection and Maintenance

Recognition that vehicle maintenance is important to the emissions control effort has been growing. The 1970 Clean Air Act Amendments instructed the EPA to work with the states to develop mandatory inspection and in-use standards programs; this charge was repeated and strengthened in the 1977 Amendments. But both the EPA and the states have been laggard in this. Only a few states and local communities currently have mandatory inspection and in-use standards programs. Maintenance in fact is not being greatly encouraged.

The EPA is likely to put greater pressure on the states in the future. If history is any guide, it will encounter severe political resistance. The New Jersey inspection program was delayed for two years because of motorist objections. In 1965, California tried to make the retrofit of blow-by devices on older cars mandatory; but motorists objected, and the program was rescinded.[17] In 1973-1975, California tried to make the retrofit of exhaust control devices mandatory on older cars; again motorists objected, and again the program was rescinded.[18]

In part, motorists object to the imposition of another set of costs; we would all like to have cleaner air without having to pay for it. In part, they seem to fear being caught with an automobile that simply cannot pass the in-use standards, or that will require devices that are too costly, or might severely impair the performance of their cars.

Ironically, the required inspection and in-use standards, with the required maintenance implied thereby, may be too late to play their proper role. On top of expensive required emissions devices on new cars, the required maintenance may simply be too expensive for the extra emission reduction benefits that it brings.

Some recent EPA restorative maintenance surveys appear to point in this direction. In 1976, EPA selected a total sample of 300 in-use 1975 and 1976 model year cars in Chicago, Detroit, and Washington, D.C. Emissions tests were administered before and after a series of maintenance procedures were performed on the cars. Seventy-four percent of the vehicles had at least one malperformance of an emissions-related component or system. The before and after emissions levels are given below in Table 7.[19] Fuel economy increased slightly, from 13.74 to 13.95. But the estimated maintenance costs (with labor valued at $15.00/hour and replacement parts valued at retail prices) were $41.44 per car.[20] The only substantial reduction was in CO emissions, and the costs to achieve it may be too high. With over 140 million motor vehicles on the road, $41 per vehicle comes to a total of over $5.7 billion.

Table 7

Pre- and Post-Maintenance Performance Levels

in 300 EPA-Selected Sample of 1975 and 1976 Model Year Cars

	Pre-Maintenance (grams/mile)	Post-Maintenance grams/mile)
Hydrocarbons	1.32	0.87
Carbon monoxide	20.27	7.65
Nitrogen oxides	2.82	2.55

Unfortunately, the studies cannot tell us about subsequent deterioration and hence they cannot tell us if this is a one-time-only expenditure to achieve permanently the CO emissions reductions or whether expenditures of this magnitude would be necessary, say, annually to achieve those emission reductions. If the former, they are probably worthwhile; if the latter, certainly not. Also, they cannot tell us anything about older cars, for which the emissions might be greater but for which the maintenance costs would also be greater.

In short, in this area as in all others, some careful cost-benefit analysis should be done to see if the extra emissions reduction are worth the extra costs. It may well be the case that required inspection, in-use standards, and the consequent required maintenance, on top of the expensive required emission control devices on new cars, is an idea whose time has passed.

IV. An Effluent Fee Program

The basic logic underlying an effluent fee is that polluters ought to be made to pay the marginal social costs of their polluting activities. By keying fees paid to actual emissions, such a policy allows individuals to take the most efficient actions open to them. If pollution avoidance is inexpensive, individuals will have an incentive to undertake avoidance actions; if pollution avoidance is expensive, they will choose instead to pay the fee. But, if the fees are properly structured to represent the marginal social costs of pollution, either choice represents an efficient outcome.

A thorough effluent fee program would involve fees levied on all motor vehicles in use and on all easily measured harmful pollutants.[21] Fees would be based on short emissions tests conducted annually, similar to the

tests and procedures currently done by the State of New Jersey. The total fee paid would be based on the mileage driven in the previous year, the emissions reported on the test, and the particular fee schedule. Fee schedules would vary geographically according to the severity of the local pollution problem. Urban areas with serious pollution problems would likely levy stiff fee schedules; rural areas with less severe problems would levy lower schedules. The direct costs of annual testing would probably be modest, particularly if the testing were done in conjunction with annual safety inspections.[22]

Let us examine the consequences of such a fee program. Individuals would have an incentive to seek out and maintain "clean" cars. The companies would have a direct incentive to build "clean" cars and to advertise that fact. The mix of cars would be adjusted so that the "dirtier" cars were shipped to the low-fee areas, where pollution problems were less severe, and the "cleaner" cars were shipped to the high-fee areas, where pollution problems were more severe. The proper balance between devices and maintenance effort would be found. The durability of the devices would become an important consideration for motorists and the companies. Further, the companies would have a clear incentive to develop new emissions reduction technology. The incentives for brinkmanship and for collusion to delay the introduction of new technology would no longer be present. The strengths of the price system - motivating private individuals and corporations to pursue their own self-interests in finding efficient ways to reduce costs and maximize benefits - would be brought into play.

Even an effluent fee system that only applied to new vehicles (again, levied at the local geographical area, with fees based on estimated lifetime emissions), though a far inferior second-best policy because of the absence of

incentives for maintenance, would nevertheless be a far superior policy to our current standards approach. Again, the same motivations (except for maintenance effort) would be present.

Three possible objections to effluent fees need to be laid to rest. First, there is the question of equity. Will a fee system pose undue hardships for low-income individuals? The answer is that, compared to the current uniform standards approach, it would likely lessen the average burden on low-income individuals. As numerous studies have shown, the current standards program is far from costless.[23] Current new cars cost roughly $200 more because of emissions control equipment, plus a present discounted cost of about $100 in extra maintenance and decreased fuel economy. The 1980s models, embodying tighter standards, will cost appreciably more. The 1973 and 1974 model cars were especially costly, because of the decreased fuel economy caused by the exhaust gas recirculation necessary to meet the NO_x standards of those years. These costs eventually filter through to the used car market. Low-income individuals do not escape them, regardless of whether they are new car or used car buyers. In fact, as Harrison and Dorfman[24] have demonstrated, the distribution of costs of the present emissions standards program is regressive; i.e., low-income households pay a higher percentage of their incomes to cover the costs of emissions control than do higher income households.

At the same time, the benefits from emissions reduction seem to be distributed relatively uniformly among income classes. Though low-income households are relatively overrepresented in central cities, where pollution problems are serious and, consequently, where the benefits from emissions reduction are high, they are also overrepresented in rural and semirural areas, where pollution problems are considerably less severe and hence where the benefits

from emissions reduction are low. On a net cost-benefit basis, the impact of the current standards program is regressive.

By contrast, an effluent fee program with different fees for different geographical areas would mean that low-pollution areas could charge lower fees and thus cause less emissions reduction and less costs in those areas. Not only would this be more efficient than the present uniform national standards, but, because of the overrepresentation of poor households in rural and semirural areas (where private autos tend to be used more and public transportation to be used less than in urban areas), the lower costs in these areas would improve overall equity.

A second possible objection to effluent fees is that different fee schedules in different geographic areas will pose administrative burdens for governments and marketing burdens for the automobile companies.[25] This need not be the case, however. State and local governments currently levy taxes and fees at rates that differ among them. There surely is some evasion and fictitious residency claims as a consequence, but these have not posed such a large administrative burden as to cause the states and local governments to conclude that uniform tax rates and fees are superior. The same would surely be the case for differential effluent fees. As for the companies, they are quite good at altering production mixes in response to consumer demand. The addition of consumer demands based on effluent fees would not add appreciably to their burden.

Third, there is the question whether research and development programs, and efforts at technological change, by the automobile companies will respond to the incentives of an effluent fee program. We have abundant evidence that individuals and companies do respond to economic incentives in

their choices of goods and of inputs into production processes, substituting capital for labor, etc. The question of technological change responding to economic incentives is somewhat different: the usual evidence is concerned with relatively short-run substitutions, whereas technological change is concerned with longer run dynamic processes. Nevertheless, we need not rely on the old saw that there are hundreds of engineers in Detroit who would sell their grandmothers for the opportunity to save a dollar per car. There is a small but growing empirical literature that does indicate that technological change in the private sector responds to economic incentives.[26] One cannot expect instant technological discoveries in response to an effluent fee program. But the incentives are clearly there. The companies would surely respond.

V. Summary and Conclusions

Our current emissions control program has definitely brought progress. But that progress has been too slow, too costly, and too inequitable. An alternative program based on effluent fees could have brought faster, less costly, and more equitable progress - and still could do so for the 1980s and 1990s, if enacted today.

Yet, none of the branches of government has shown serious interest in effluent fees. No governmental review of the automotive emissions program has considered it a serious alternative.[27] The latest such report, compiled by the Federal Task Force on Motor Vehicle Goals Beyond 1980, dismisses it with a single reference as a possible alternative but never explores it in any depth;[28] the background panel report for the study did not even mention it.[29]

Legislators have been equally uninterested. Questions about effluent fees rarely arise in Congressional hearings.[30] In the Senate hearings on the 1977 Clean Air Act Amendments, the question was raised a few times but quickly dropped.[31] It was never raised in the House hearings.[32]

Equally distressing is the automobile companies' seeming lack of interest in effluent fees. In response to the few questions that were raised, the auto company representatives were baffled and disinterested. Some had never heard of the concept before.

The automobile companies are quick to tout the strengths of the price system in other areas, such as fuel economy regulation.[33] Yet, as we have shown, an effluent fee program would bring these same strengths of the price system to bear on the pollution problem. If the companies mean what they say about the price system, it is time that they consider seriously and endorse an effluent fee approach as the way to deal with the nation's air pollution problems.

Footnotes

* Professor White is currently with the Council of Economic Advisers.--Ed.

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   F. P. Grad, A. J. Rosenthal, et al., The Automobile and the Regulation of Its Impact on the Environment (Norman, Okla.: Oklahoma University Press, 1975).

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NAS, Report by the Committee on Motor Vehicle Emissions. Washington, DC: November 1974.

2. Earlier, California had required blow-by emission controls for the 1963 model year and in 1964 required exhaust controls for the 1966 model year.

3. A more detailed discussion of the program is provided in the sources cited in footnote 1.

4. For a good development of this theme, see Krier and Ursin, Pollution and Policy (Berkeley, Calif.: University of California Press, 1977).

5. Other reviews of this history are found in L. J. White, The Automobile Industry Since 1945 (Cambridge, Mass.: Harvard University Press, 1971), Chapter 14.

Footnotes (continued)

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Mills and White "Government Policies," (1978), pp. 349-355.

6. Some of the Justice Department's evidence concerning the alleged collusion was put into the Congressional Record of May 18, 1971, by Representative Phillip Burton. It is reprinted in U.S. Senate (1973), pp. 445-456.

7. See Krier and Ursin, Pollution and Policy (1977) p. 147.

8. R. Nader, Unsafe at Any Speed (New York: Pocket Books, 1965).

9. This decision is found in U.S. Senate (1973), pp. 2-51.

10. U. S. Environmental Protection Agency, Automobile Emission Control - The Technical Status and Outlook as of December 1976 (Washington, D.C.: U.S. Government Printing Office, 1975).

11. NAS, "Report of the Conference on Air Quality and Automobile Emissions, May 5, 1975, to the Committee on Environmental Decision-Making," June 5, 1975.

12. Ford Motor Company, Advanced Emission Control Program Status Report, Submitted to the Environmental Protection Agency, January 1978.

13. A. P. Berens and M. Hill, Automobile Exhaust Emission Surveillance - Analysis of the FY 1974 Program, Ann Arbor, Mich.: Emission Control Technology Division, Office of Mobile Source Air Pollution Control, Office of Air and Waste Management, USEPA, September 1976) Table 40, p. 61.

14. Since the selection of these cars involves motorists voluntarily being willing to let the EPA test its cars, there may be a downward bias to the reported figures. Owners of particularly "dirty" cars may be embarrassed and reluctant to allow their cars to be tested.

15. J. T. White, III, "An Evaluation of Restorative Maintenance on Exhaust-Emissions from In-Use Automobiles," Society of Automotive Engineers, Technical Paper Series #780082 (1978), Table 3, p. 5.

16. See Mills and White "Government Policies" (1978), p. 398.

17. Except that retrofit was made mandatory at the time of transfer of title. See Krier and Ursin Pollution and Policy (1977), pp. 148-153.

18. Again, retrofit was made mandatory at the time of transfer of title. See Krier and Ursin, ibid., pp. 240-247.

19. J. C. Bernard and J. F. Pratt, An Evaluation of Restorative Maintenance on Exhaust Emissions of 1975-1976 Model Year In-Use Automobiles, Ann Arbor, Mich.: Emissions Control Technology Division, Office of Mobile Source Air Pollution Control, Office of Air and Waste Management, USEPA, December 1977.

20. R. Gafford and R. Carlson, Evaluation of Restorative Maintenance on 1975 and 1976 Light-Duty Vehicles in Detroit, Michigan. Ann Arbor, Mich.: Emission Control Technology Division, Office of Mobile Source Air Pollution Control. Office of Air and Waste Management, USEPA, May 1977, Appendix G.

Footnotes (continued)

20. (cont.)

D. R. Liljedahl and J. Terry, Evaluation of Restorative Maintenance on 1975 and 1976 Light-Duty Vehicles in Chicago, Illinois, Ann Arbor, Mich.: Emission Control Technology Division, Office of Mobile Source Air Pollution Control, Office of Air and Waste Management, USEPA, January 1977, p. 33, Appendix G.

21. Ideally, the fees on motor vehicles would be in conjunction with fees on stationary sources.

22. A complete, feasible, and practical fee schedule and program has been presented by Mills and White "Government Policies" (1978), pp. 385-393.

23. See the studies cited in footnote 1.

24. D. Harrison, Jr., "Controlling Automotive Emissions: How to Save More Than $1 Billion Per Year and Help the Poor Too," Public Policy 25 (Fall 1977), pp. 527-533.

N. S. Dorfman, "Who Will Pay for Pollution Control? - The Distribution of the Burden of the National Environmental Protection Program, 1972-1980," National Tax Journal, 28 (March 1975), pp. 101-115.

25. Similar objections are raised by the Panel on Air Quality, Noise and Health (USDOT, 1976a, pp. 5-54 to 5-58) to an expanded two-car strategy in which high pollution areas require stringent controls (as does California currently), while the remainder of the country requires less stringent controls.

26. For summaries of this literature, see B. Gold, (ed.), Research, Technological Change, and Economic Analysis (Lexington, Mass.: D. C. Heath, 1977).

Footnotes (continued)

26. (cont.)

H. P. Binswanger, V. W. Ruttan, et al., Induced Innovation (Baltimore: Johns Hopkins University Press, 1978).

L. J. White, "Is Technological Change Responsive to Economic Incentives?" New York University, Faculty of Business Administration, Working Paper Series #77-98, December 1977, which also contains some new evidence on this question.

27. See the government studies cited in footnote 1.

28. USDOT (1976b), p. 17-2.

29. USDOT (1976a).

30. L. J. White, "Effluent Charges as a Faster Means of Achieving Pollution Control," Public Policy 24 (Winter 1976a), pp. 111-125.

31. U. S. Senate, Committee on Environmental and Public Works, Subcommittee on Environmental Pollution, Clean Air Act Amendments of 1977 - Hearings, Part 1 (Washington, D.C.: U.S. Government Printing Office, 1977).

32. U.S. Environmental Protection Agency, Progress in the Implementation of Motor Vehicle Emission Standards Through June 1975, Washington, D.C.: USEPA, 1976.

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MULTINATIONAL AUTOMOBILE ENTERPRISES
AND REGULATION: AN HISTORICAL OVERVIEW

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The automobile industry is made up primarily of multinational enterprises that have foreign investments in manufacturing, assembly, selling, and servicing. Table 1 indicates the largest of these companies and their multinational involvements. Suppliers are also multinational.[1] Specific markets, by contrast, are national, those within the European Economic Community perhaps excepted.[2] Governments set tariffs and taxes; provide incentives; and establish safety, emission, and conservation standards. Costs in building and operating cars vary by country, and people still think of "American," "German," "French," and "Japanese" vehicles. Thus, while enterprises extend themselves internationally, governments and popular viewpoints remain national in both policy and vocabulary.

None of this is new. Indeed, the automobile industry has participated in international business almost from its inception. Ford - now probably the most international of the car companies in terms of foreign assets as a percentage of total assets (see Table 1) - exported in 1903 the sixth car it built.[3] From the 1890s, races and exhibitions attracted participants from many countries.[4] Trade journals reported industrywide events beyond national arenas.

Table 1

Foreign Business of Major Vehicle Producers, with sales over 3.5 Billion, end 1976

Rank by Sales a/	Company	Nationality	Government ownership (Percentage)	Total consolidated sales (Millions of dollars)	Foreign sales: Exports from home country	Foreign sales: Sales of overseas affiliates to third parties	Foreign assets as percentage of total assets	Foreign earnings as percentage of total earnings	Foreign employment as percentage of total employment
					As percentage of total consolidated sales				
2	General Motors	United States	-	47,181	-----24------		12	18	...
4	Ford Motor	United States	-	28,840	-----31------		40	45	51
14	Chrysler	United States	-	15,538	-----28------		33	22	47
20	Renault	France	100	9,353	-----45------		...	...	...
24	Daimler-Benz	Germany, Federal Republic of	14 b/	8,938	39	21	...	...	17 c/
26	Volkswagenwerk	Germany, Federal Republic of	40	3,513	-----62------		...	...	32
34	Toyota Motor	Japan	-	7,696	35	...	2	...	15 c/
38	Peugeot-Citroen	France	-	7,347	19	28	...	...	16
42	Nissan Motor	Japan	-	6,584	41	25	6	...	15
72	Fiat	Italy	-	4,658 d/	...	...	...	...	19
82	British Leyland	United Kingdom	100	4,178	36	18	...	...	12
102	Volvo	Sweden	-	3,615	44	24	...	...	27

Source: United Nations, Economic and Social Council, Transnational Corporations in World Development, New York 1978.

a/ Ranked in descending order of total consolidated sales; rank of major industrial corporations.

b/ Kuwaiti interest.

c/ Estimated.

d/ Parent company sales.

Pre-World War I

In the pre-World War I context government regulation meant the Red Flag Law, tariffs and, to a lesser extent, taxes. These government interventions had impact, but the differences between the European and U.S. automobile industries seemed to be shaped more by economic and geographic than by regulatory factors. Indeed, the handcrafted, highpowered luxury cars predominated in countries where skilled labor was available, where there were wealthy consumers, and where markets were small. The mass-produced car was a product of the United States, where the cost of skilled labor was high, where there was a vast potential demand - because the country was physically enormous and per capita income was the highest in the world - and where the price of gasoline was undoubtedly the lowest in the world. (America was an exporter of oil products.)

The birthplace of the passenger car was in Germany, where the Daimler and Benz models of 1885-1886 were the first commercially viable gasoline-powered products.[5] Early French units included the Panhard & Levassor (built on a Daimler license), the Delaunay-Belleville, and the Renault. In March 1899, Louis Renault and his brother founded Société Renault.[6] Peugeot also began building automobiles in France in the 1890s.[7]

In Britain, where railroad interests feared competition from steam (and later, gasoline) carriages, the automobile industry was slower to emerge. A "Red Flag" Law of 1835 set a maximum speed of four miles per hour on all free-moving, self-propelled vehicles and required that they be preceded by a man carrying a red flag! When that law was finally repealed in 1896, a licensee of the German Daimler enterprise, Daimler Motor Co., Ltd., was the first to manufacture cars in England.[8]

At the dawn of the twentieth century, European-made automobiles were handsome, handcrafted, chiefly high-powered, units, designed for the wealthy.[9] In the United States, the elite of Newport, Rhode Island, drove the elegant and expensive French vehicles. At the turn of the century, European automobile output was greater than American.[10] The cars were sold in limited, high-income markets in the United States and Europe. That Daimler licensed producers in France and England already indicated segmentation of national markets.

The United States developed an indigenous automobile industry behind a 45 percent ad valorem tariff.[11] American-made products were initially inferior to their European counterparts. Thus, a contemporary described the 1902 Olds as having a "coughing, spitting, one-cylinder engine that seemed to be suffering the final stages of shaking palsy."[12] The Olds was by no means an isolated instance of poor construction.

As late as 1906, U.S. imports exceeded U.S. exports of cars and parts in dollar value ($4.2 million versus $3.5 million). Figures on the number of cars exported in 1906 are not available, but the quantity was probably larger than the 1,106 cars that were imported, since U.S. exports were relatively low-priced and imports higher priced. In 1907, when the dollar value of U.S. passenger car exports surpassed imports, the average price per automobile exported was $1,709, while the average price per car imported was more than twice that, or $3,436.[13] As Ford Motor Company and others initiated volume production, the quality of cars on this side of the Atlantic improved. From 1907, and for the next half century, America was a net exporter of passenger cars, measured both in number of cars and in dollar value.

U.S. wages were higher than those in Europe, and the American industry substituted machinery for labor in making automobiles. What emerged

in the United States were mass-produced "cheap cars" made with interchangeable parts, assembled on a moving assembly line. The products were designed to reach a large domestic market - rugged vehicles, easily repaired. The concept became entirely distinct from that which had arisen in Europe. Behind the high protective tariff wall, the U.S. industry introduced economies of scale and economies of speed of production, and prices declined accordingly.[14]

Certain European firms gave up the American market. The British exported to their colonies, almost exclusively.[15] The French remained large exporters, but did not sell large quantities in the United States.[16] By contrast, the German Daimler firm's affiliate, the Daimler Manufacturing Company, jumped over the American tariff wall and in 1905 began manufacturing American-made Mercedes at a factory in Long Island. The car was advertised as a "faithful reproduction in materials, workmanship and design of the foreign car." Offered at $7,500, it was $3,000 less than the "Foreign Mercedes."[17] In 1909, the Italian Fiat Company began production of its luxury cars in Poughkeepsie, New York.[18]

The output of Mercedes and Fiats in the United States is unknown, but when the Mercedes factory burned down in 1913, it was not rebuilt. The war in Europe in 1914 was undoubtedly one reason; a second was the development of a fully competitive American industry; and a third was, as the historian for Mercedes-Benz reports, that the American Mercedes was "no match for the German Mercedes."[19] The 1913 U.S. tariff had nothing to do with the decision not to reopen, for while the U.S. rate of duty was lowered to 30 percent for cars under $2,000, the high-priced Mercedes was still subject to a 45 percent levy.[20] Fiat's Poughkeepsie plant was sold to the American Duesenberg Motor

Company in 1918.[21] U.S. imports of finished cars declined from 1,305 units in 1910 to a mere 708 in 1914. In 1914, automobile imports were barely .3 percent of U.S. production.[22]

By contrast, U.S. passenger car exports reached about 7.5 percent of production in 1914;[23] Ford Motor Company already had factories in Canada (started in 1904-1905) and England (built in 1911-1912), where its initial models were replicas of the U.S.-made units. The Canadian facility gave Ford the opportunity to penetrate a market that was protected by a 35 percent tariff. While England was not circled by a tariff, transportation costs warranted local production. By 1914, then, the Ford Model T was not only in first place in the United States (where it sold for $440)[24] but in Canada and England as well.

Europeans looked in awe to the American automobile industry. By 1914, more private automobiles were in use in the United States than in all the rest of the world.[25] Even before World War I, some European car makers had begun to imitate U.S. production methods and to use American machine tools.[26] In England, William Richard Morris (later Lord Nuffield) produced the Morris-Oxford car in 1913, designed to compete with the Model T.[27] On the Continent, where the automobile companies built vehicles solely for the very wealthy, however, costs of purchase, ownership, and operation (including gasoline and taxes) were far higher than in the United States.

During World War I, the U.S. automobile industry continued to perfect mass production methods, and the importation of cars essentially stopped. Between 1914 and 1919 the number of passenger cars in use in the United States quadrupled.[28] Meanwhile, in 1915, the first of the popular British "small cars,"[29] the Morris-Cowley, was introduced in England. French and Italian industry remained unchanged, while the industry in Germany was virtually destroyed by the war.[30]

The Inter-War Years

At the end of World War I, the U.S. automobile industry had no rival. Domestic output was higher than ever before. Exports in 1920 reached 16.1% of production. Imports continued to be negligible (about one-tenth of 1% of U.S. output, three-quarters of which came from Canada).[31]

The 1920s were years of triumph for U.S. automobile companies. Mass production had been achieved before World War I; now, for the first time, mass consumption matched it as the United States became the world's first mass market for passenger cars. The decade began with the Ford Model T capturing 55% of all car sales; the Runabout sold for a mere $260 at the end of 1924. General Motors, which had been formed in 1908, decided to provide cars to satisfy the taste of every consumer and recognized that Americans wanted more than basic transportation. Thus, although General Motors' cars were mass-produced, they offered variety in styling, as well as comfort, accessories, and power.

The American "love affair" with the automobile had begun.[32] By 1929, there was one car for every five Americans;[33] that year 4.5 million passenger cars were sold in this country,[34] and U.S. motor vehicle production equaled 85.3% of world output.[35] American automobile makers (Chrysler joined the leaders in 1925) developed sales and service networks. Credit was made available to finance car purchases.

Although the U.S. tariff was lowered in 1922 to 25% (or to a duty equal to that imposed by the country from which the import came but not to exceed 50%), imports remained under one-tenth of 1% of U.S. production.[36] No foreign producer of cars could compete in the American market. Barriers to entry lay in the major U.S. companies' efficiencies (economies of scale),

their product designs, and their extensive marketing organizations, all of which were more effective than tariff protection.[37] With the depression of the 1930s, U.S. automobile sales sank.[38] But American automobile companies still had little to fear from foreign competition,[39] and in June 1934 the tariffs on automobiles were effectively reduced to 10%.[40]

In the early 1930s, the 7-horsepower British "baby" Austin car was produced, under license, in western Pennsylvania. Austin advertised that "big" U.S. cars cost about 2 1/4 cents a mile (for gas, oil, and tires) to operate, while its automobile was a bargain to run at 3/4 of a cent per mile. Depression notwithstanding, the baby Austin (the initial cost of which was $5 more than the Ford Model A) did not prove popular; its small size made it a butt for American cartoonists' and gagmen's ridicule.[41]

The United States was, in the 1920s and 1930s, the world's largest exporter of cars (see Table 2). U.S. producers could not fill foreign demand through exports alone; Ford and General Motors found that to serve foreign markets they had to have their own assembly and manufacturing plants located abroad. By 1929, U.S. automobile companies had 68 foreign assembly plants.[42]

Table 2

Exports of New Cars and Car Chassis
(in thousands of units)

	U.S.	Canada	U.K.	France	Italy	Germany
1929	340	65	39	39	24	5
1932	41	10	32	14	6	9
1937	229	44	78	20	26	52
1938	162	40	68	19	18	65

Source: George Maxcy and Aubrey Silberston, The Motor Industry, London: George Allen & Unwin, 1959, 228.

Because of the obstacles to trade, U.S. assembly operations in the largest foreign markets soon were transformed into manufacturing facilities. These foreign barriers to trade included tariffs and taxes, and in the 1930s, exchange restrictions along with government local purchase requirements - in short, regulatory rather than market barriers. To be sure, Europeans also rejected U.S. imports because of "inadequate roads, expensive fuel, and meager repair facilities."[43]

In the inter-war years, automobile makers in Canada and Europe adopted mass-production methods. Canadians followed the U.S. pattern and built the North American-type car. Because of the Canadian tariff, the "Canadian market" remained separated from that of the United States. Nonetheless, by 1929, 83% of the cars, trucks, and parts made in Canada were produced by subsidiaries of U.S. enterprises.[44] To obtain economies of scale, these subsidiaries exported automobiles to Australia, New Zealand, South Africa, and, in some cases, to South America.[45]

Britain had abandoned free trade in 1915 and imposed a 33 1/3% tariff on automobiles imported from outside the Empire.[46] At war's end, it retained this tariff; in 1919 the British Board of Trade estimated that with "the adverse exchange, freight, packing, and insurance charges," the British passenger car was protected to the equivalent of an 88% surcharge.[47]

The British horsepower tax shaped that nation's industry, further defining and protecting it. British car designers offered a small-bore, long-stroke engine which met the tax formula requirements and thus minimized annual taxes for the buyer.[48] These engines obtained better gas mileage than the U.S.-type car. With high-priced fuel in England, this gave them a further advantage there. Even though it produced in England, after 1924, Ford Motor

Company fell far behind Morris and Austin, which had copied U.S. assembly-line methods of production to make small, low-priced, low-powered units, with low costs of operation. Ford ultimately realized that if it were to sell in Britain, it could not market a North American-type vehicle, and had to undertake major design modification. Thus, in 1932, Ford introduced the Model Y, the first car specifically designed by it for a foreign market.[49]

British economists believe the horsepower tax, which imposed the special design requirements, retarded British car exports.[50] Exports were further hampered by the overvaluation of the pound, especially in the period 1925-31. In short, by the 1920s, the British had adopted U.S. methods of mass production; government policies greatly affected engine design and incidentally, probably served to impede exports.

French industry also imitated U.S. production techniques; Citroen introduced a "popular" car in 1919; by 1922, "mass-produced," "light" cars were offered by the principal French manufacturers, including Renault and Peugeot.[51] The French government set a 45% tariff.[52] To penetrate the French market, Austin Motor Company licensed the French production of "Rosengart" vehicles in the late 1920s.[53] By the end of 1931 the French customs duties on automobiles and parts reached more than 90% ad valorem.[54] Ford began manufacturing in France in 1934;[55] that same year, Simca (a successor to a Fiat dealership) started to build Fiats in France.[56] Soon the French imposed import quotas,[57] and like the British market, the French one became distinct.

In 1924, Adam Opel A.G., which began to make cars in Germany in 1898, resumed post-World War I operations, adopting U.S. mass-production methods, but making a small car. That year Opel became the leader in the German automobile industry; in 1929, General Motors instantly obtained first

place in this German industry when it purchased control of Opel.[58] Tariffs, foreign exchange restrictions, and then government-imposed national content requirements made local production imperative.[59] In 1931, to remain competitive, Ford started to manufacture cars in Germany. (It had had an assembly plant there since 1926.)

At the Berlin automobile show in February 1933 the new Chancellor, Adolf Hitler, promised to reduce German automobile taxes and to start a formidable road construction program.[60] At the March automobile show the next year, Hitler was more explicit. Automobiles should not be merely for the privileged. Hitler proposed a "Volkswagen," a cheap dependable car for "millions of new purchasers," a standardized, all-German car.[61] This was a Model T concept. The car envisaged by Hitler was not actually produced until after World War II, although prototypes were made in 1938. Throughout the 1930s, therefore, G.M.'s Opel retained first place in the German market.[62] It is a paradox often encountered that governmental protection of national industry meant protection of a unit of a multinational enterprise based elsewhere.

Everywhere on the European continent in the early 1930s, tariffs and nontariff barriers blocked international trade in automobiles. "Can a manufacturing plant be made to pay when output is confined within the limited areas which national tariffs are building up?" the chief executive of the British Ford operation asked plaintively in December 1933.[63] It was a good question. In different countries in Europe, multinational corporations produced models that had no interchangeable parts. Each European nation set tariffs, taxes, and standards that provided obstacles to trade and economic integration. Each promoted its own industry. These regulations shaped and defined markets. The multinational enterprises simply conformed to them.

Vehicles produced in the United States for a mass market, where gasoline prices were relatively low and distances great, came to be totally different in design from the "small" cars sold in Europe. There, costs of operations were high; low-powered and light cars conserved gasoline; distances were not great; automobile ownership remained limited. The Canadian market - although it had the same products as that of the United States - could not benefit from integration with the U.S. market because a tariff "protected" the inefficiencies caused by absence of scale production by U.S. subsidiaries in Canada. Table 3 indicates the costs of direct annual taxes, taxes on fuel, and compulsory insurance of a comparable car traveling a comparable number of miles per year in the immediate pre-World War II period. It shows vividly that government-mandated costs of operating a vehicle in the United States and Canada were far below those in Europe.

Table 3

Annual Direct Taxes, Taxes on Fuel, Compulsory Insurance Costs - 1939

North America	Index (U.S.=100)	Europe	Index (U.S.=100)
U.S.	100	U.K.	400
Canada	85	France	292
		Germany	231

Source: Society of Motor Manufacturers and Traders, The Motor Industry of Great Britain 1939, 141, based on a 1,500 cc car, traveling 8,000 miles per year.

Throughout Europe the railroad and the bicycle were more common forms of transportation than the passenger car. In 1939, in the United States, one in five persons had a car (roughly the same as in 1929); in Canada about one in nine; in France one in twenty; in Great Britain one in twenty-three; and in Germany, one in fifty-six.[64] Mass production techniques had arrived in Europe in the inter-war years, but mass consumption had not.

Elsewhere around the world, in Latin America, Asia, and South Africa, assembly plants were built by Ford and General Motors. Automobile production was started in the Soviet Union (with Ford's technical assistance). In Australia and Japan, the foundations for car manufacturing were established.

During World War I, the Australian government had prohibited the import of car bodies, to save shipping space. Australians began to manufacture car bodies, and in the post-World War I years, the Australian government protected the new industry with a high tariff. From 1925, Ford assembled cars and manufactured bodies in Australia.[65] General Motors in 1926 started assembly in Australia and in 1931 acquired Holden Motor Body Builders Ltd. In 1928, three-quarters of all automobile registrations in Australia were North American-type cars and one in every fourteen persons had a car, a ratio bettered only by the United States, Canada, and New Zealand.[66]

In Japan, Ford and General Motors began assembling cars in 1925 and 1926, respectively. In 1930, only 458 motor vehicles were manufactured in that nation, all by Japanese producers. Imports (mainly those of Ford and General Motors) dominated the market. During the 1930s, Japanese manufacturing emerged with Nissan and Toyota. American enterprises wanted to manufacture in Japan, too, but Japanese government regulations effectively barred the U.S. firms from doing so.[67]

In summary, by the eve of World War II, North America had mass production <u>and</u> mass consumption of automobiles. In 1937, despite the spread of automobile manufacturing, the United States still accounted for 76% of world motor vehicle output.[68] Europeans had imitated U.S. production techniques, and devised distinctive products suitable for national market conditions (in many cases determined by government regulation), but their home markets

remained small and Europe still did not have mass consumption of passenger cars. Outside of Europe and North America, a number of countries had automobile assembly plants; Australia and Japan had the rudiments of manufacturing, fostered by national government policies.

1945-1970

The manufacture of civilian automobiles virtually ceased worldwide during World War II. In its aftermath, major alterations in passenger car markets took place as world trade and investment resumed and as a new world economy was established with the dollar as the key currency. Change occurred in a world where U.S. international economic policy pressed for a "free market oriented trade and investment system."[69]

Europe was plagued by a severe dollar shortage. Governments there would not allow scarce dollar resources to be spent on automotive imports from the United States. The British government set an export target of one-half the cars produced in that country; when this was met, the target was raised to two-thirds.[70] In 1947, the British government revised its prewar horsepower tax, and the next year introduced a new automotive tax structure designed specifically so as not to impede British exports.[71] The 1949 devaluation of the pound provided a further impetus to British car sales overseas. That year, the United Kingdom replaced the United States as first in world exports of new cars.[72] By 1950, only 25% of the cars made in England were sold in the domestic market. The leader in British industry, and British exports, was paradoxically Ford of England, which exported to the world, including the United States.[73]

The British automobile industry became one of that nation's principal postwar growth industries.[74] In 1952, the two leading British-owned

producers, Austin and Nuffield, merged to form the giant British Motor Corporation, after further mergers to become British Leyland (1968). From 1949 through 1955, British industry continued to lead the world in car exports,[75] spurred on by government pressures. High purchase taxes notwithstanding, domestic consumption of automobiles also rose to new records.[76]

On the continent, recovery from the wartime disaster was slower. The French government nationalized the largest enterprise, Renault. Fiat resumed its leadership in Italian production. And both Renault and Fiat expanded internationally, establishing new foreign subsidiaries.[77]

After the war, German industry lay in ruins; but it was not by any means certain that the Allied powers would permit industrial recovery. Nevertheless, the plant the Germans had built for Volkswagen, situated in the British-occupied zone, was in limited production by 1945, using its prewar designs.[78] Henry Ford II liked the idea of acquiring the Volkswagen company, but the idea of Ford ownership died when the complexities of ownership and the liabilities of that company became apparent - some 337,000 Germans had made payments on cars they had not received[79] - and when one senior Ford executive sneered, "You call that a car?" Even the German Heinz Nordhoff, whom the occupying forces put in charge of the plant late in 1947, initially had only disdain for the bug-like creation.[80]

Nordhoff's baptism in the automobile industry had been with General Motors' Opel. Using his experience with "American practices," Nordhoff set about improving the product, reducing the noise, coping wtih "flimsy" construction, improving the engine, and going beyond basic transportation to provide more comfort and attractiveness with improvements in upholstery and paint work. Drawing on his experience with the General Motors subsidiary,

Nordhoff insisted on developing a marketing and service organization to spur Volkswagen sales. When Volkswagen started to export to the United States in the 1950s, its representatives were warned that British and other imports had entered the U.S. market, yet failed to sustain their momentum due to inadequate distribution organizations.[81] Volkswagen did not repeat their mistake. In 1956 German car output and exports exceeded that of the British and German automobile exports became the largest in the world;[82] by 1961, Volkswagen's foreign sales alone surpassed total British car exports.[83]

How much did the regulatory environment on the European continent influence the expanding automobile industry? Until 1959, the French protected their industry with high tariff walls and maintained a quota on imported cars.[84] Professor Louis T. Wells suggests that through its ownership of Renault, the French state was able to encourage exports, influence product size in the direction of smaller units, affect plant location, restrain price increases, and set a pattern for wage settlements.[85] Until 1961, Volkswagen was entirely state-owned, but its management seems to have been insulated from state intervention. Of course this became especially true after 1961, when state ownership dropped to 40%.[86] In the 1930s Volkswagen had been under state ownership, receiving state subsidies and endorsement. The influence of the regulatory environment in the postwar period seems more distant.

Unquestionably, the formation of the European Economic Community in 1957 had more impact on the automobile industry in Europe than any other single governmental action. The Treaty of Rome provided for a common market, made up of six nations: Belgium, Netherlands, Luxembourg, Germany, France, and Italy. By 1968, free trade in goods within the European Economic Community had been achieved, while a common external tariff of 17.6% protected passenger car

producers inside the six-country market.[87] The effects were extraordinary. In 1958, the first year of the common market, France imported from other EEC countries 1% of the cars sold there, Italy 2%, and Germany 7%. In 1970, French imports from other EEC nations had risen to 16%; Italian EEC imports were 28%, and German 25% of the domestic market. Free trade over borders within the EEC meant that Europe was becoming an increasingly integrated market,[88] and most important, that producers could take advantage of economies of scale. The return to convertible currency throughout most of Europe by 1959 also contributed to growing international trade. So, too, rising European affluence in the 1960s added purchasing power.

In the late 1950s, and especially in the 1960s, for the first time western Europe entered an age of mass consumption of automobiles. Increasingly, car company executives in Europe considered marketing problems and established sales and service networks. As automobiles were designed to meet mass market needs, Europeans concentrated on small, low-priced units, with low costs of operation and maintenance. Quality became important. Part of these product developments were influenced by economic concerns, such as the high cost of gasoline in Europe; part by road conditions; and part by the regulatory environment. European gasoline taxes continued to be higher than American; progressive registration fees on vehicles, according to engine capacity, influenced car size and weight, as well as engine design. In Germany, particularly, the government's continued commitment to building <u>autobahns</u> meant the need for passenger cars that could cruise at high speed, yet were economical on fuel use.[89] The economic, geographical, and regulatory environment that influenced product design protected European producers from U.S. import competition long after the dollar shortage had turned into a

dollar glut. American multinational corporations could, however, and did, invest within the European Economic Community, gain the advantages of the large protected market, manufacture appropriate products, and remain fully competitive.[90] Ford, General Motors, and Chrysler all invested heavily in manufacturing facilities within the EEC.[91]

In the 1950s, cars produced in England and on the European continent - even by multinational corporations - had no interchangeable parts. In the 1960s, multinational enterprises recognized that if output in Europe were to benefit from economies of scale and specialization, interchangeability was obviously desirable. Moreover, if Britain were to join the Common Market, as it first sought to do in 1961, standardization and interchangeability of parts would be essential. In 1968, European automobile production for the first time since the early years of the century exceeded U.S. output.[92]

In the 1950s and 1960s automobile production in the United States remained the highest of any single nation in the world. This country had the world's greatest domestic market. In the immediate postwar period, both General Motors and Ford considered introducing a light car, but surveys indicated that most Americans wanted larger automobiles and were prepared to pay for them.[93] With the baby boom and the expanding American family, with low-cost gasoline (despite the U.S. switch from net oil exporter to importer), with vast improvements in the American highway system, with new affluence in the 1950s, American consumers wanted big, showy, powerful cars - and U.S. automobile makers responded accordingly. Table 4 shows the more than doubling in horsepower of American car engines between 1950 and 1957 (from 111 to 237 horsepower). The 1955 Chevrolet was 195 inches long; the 1958 model extended 209 inches.[94] The lengthening (and also the widening) of American cars was general.

Table 4

Average Horsepower U.S. Automobile Engines 1950-1968[a]

Year	Horsepower
1968	249.0
1967	239.4
1966	232.9
1965	220.3
1964	206.3
1963	195.7
1962	182.9
1961	175.1
1960	188.2
1959	214.2
1958	227.3
1957	236.7
1956	206.8
1955	173.1
1954	150.8
1953	133.0
1952	122.1
1951	116.2
1950	110.9

[a] Weighted average based on estimated percentage of production for each model; for new automobiles only.

Source: American Petroleum Institute, Petroleum Facts and Figures, 1971, 326.

As American cars became more comfortable, roomy, powerful, and expensive, they became less competitive in world markets, and, as noted, in 1949 British car exports exceeded American and, in 1956, German foreign sales overtook the British. This did not mean that U.S. companies gave up foreign markets. Until 1968, the United States was a net exporter in the category of motor vehicles, parts, and engines. Much more important, however, were the huge investments American companies made abroad to provide appropriate automobiles for foreign markets. U.S. enterprises participated in the growing world markets primarily through direct investments rather than U.S. exports. In the 1960s as the United States began to show serious balance of payments deficits and as U.S. Government restrictions were placed on foreign investment outflows, U.S. corporations were able to continue to expand outside the United States, by reinvesting profits and borrowing abroad.[95]

While most American consumers liked the output of Detroit, certain buyers of cars in the United States did not want large automobiles. In the late 1950s, they turned to imports. In 1957, the number of passenger cars imported into the United States exceeded the number exported (see Appendix I). By 1959, automobile imports, which in 1957 represented a mere 3.5% of the U.S. market, surged to 10.2%. Moreover, in 1959, American Motors' Rambler - an economy car - captured 6% of the U.S. market.[96] Among the imports in 1959 were the so-called "captives" (products produced by foreign subsidiaries of U.S. firms). These cars had been produced for sale abroad. In an emergency, they could fill U.S. producers' needs at home. Thus, General Motors brought in Opels and Vauxhalls; Ford imported its English Anglia and German Taunus. The rise in imports into the United States coincided with the first drop (in

1956) in the U.S. tariff since 1934; the tariff declined from 10% to 9.5% ad valorem, hardly enough to make a significant economic difference (but perhaps a psychological boost to the importer).

Ford, General Motors, and Chrysler responded to the new American demand for economy cars with domestically produced "compact" units. Although they were not small in European terms, they were shorter and narrower than the standard American models. For a limited time, they cut sharply into imported car sales.[97] U.S. companies did not need to import "captives" when they had their own more suitable U.S. offerings; foreign producers such as Renault and Fiat which had not built up sales and service organizations in the United States, could not meet the new domestic competition.[98] Volkswagen's rise in sales also slowed.[99]

Then, in response to domestic demand during the 1960s, American cars once more grew in size and power. Gasoline remained cheap in the United States, and the American public still desired the larger, more powerful cars. Innovations in U.S. industry were in comfort and styling. Indeed, as U.S. incomes rose, the purchase of new cars represented an even smaller portion of the American family budget; Americans could afford the big car.[100]

Once more, some American buyers were not satisfied with U.S. products and imports resumed their upward climb, until 1968 when, for the first time since 1906, the dollar value of U.S. imports of motor vehicles, parts, and engines exceeded the dollar value of such U.S. exports (see Appendix II for the actual figures). In 1906, when the dollar value of car imports into the United States had exceeded exports, imports had been the expensive cars; sixty-two years later the imports were primarily economy cars. In 1968, no

producer in the United States made a new car that had a manufacturer's suggested list price below $1,800; fully seventeen different models of imported cars sold at port-of-entry for under $1,800.[101]

Meanwhile, the United States' automobile tariff had continued to drop, reaching a mere 5.5% in 1968.[102] In 1965, the United States and Canada signed the Canadian Automobile Agreement, which removed tariff duties that impeded trade between the two countries in specified motor vehicles and original equipment automotive parts. Its goal was to provide conditions "in which market forces may operate effectively to attain the most economic pattern of investment, production, and trade."[103] The agreement provided the basis for an integrated North American automobile market.

Under the Canadian Automobile Agreement, as Table 5 and Figure 1 indicate, bilateral commerce expanded rapidly. Indeed, comparing Table 5 and Appendix II, one sees that in 1970, 80% of American motor vehicle, parts, and engine exports were to Canada and 52% of U.S. imports were from Canada. After 1965, U.S. passenger car imports from Canada exceeded exports. Although multinational companies refer to a "North American-type car," government regulations continued to prevent the full integration of the U.S. and Canadian markets.[104]

In the 1960s, because of low U.S. tariffs and the lower costs of production in Europe, and because of product differentiation, European car makers did not need to invest in manufacturing or even assembly in the United States to reach this market. Companies such as Volkswagen and Daimler-Benz,

Table 5

United States - Canada Trade Automotive Products, 1964, 1970-76
U. S. Imports - Canadian Imports

Millions of U. S. Dollars

	1964	1970	1971	1972	1973	1974	1975	1976 1/
U. S. exports 2/								
Cars	34	631	985	1,075	1,439	1,657	2,142	2,354
Trucks	23	263	334	504	643	916	922	985
Parts	577	2,019	2,448	2,866	3,552	3,980	4,409	5,550
Sub total	634	2,913	3,767	4,445	5,634	6,554	7,472	8,889
Tires and tubes	6	23	36	51	92	223	170	116
Total exports	640	2,936	3,803	4,496	5,726	6,777	7,643	9,005
U. S. imports								
Cars	18	1,474	1,924	2,065	2,272	2,595	2,809	3,477
Trucks	4	564	587	713	789	887	917	1,363
Parts	49	1,080	1,481	1,795	2,172	1,997	2,008	2,983
Sub total	71	3,118	3,992	4,573	5,233	5,479	5,734	7,823
Tires and tubes	5	14	8	22	68	65	67	166
Total imports	76	3,132	4,000	4,595	5,301	5,544	5,801	7,989
Net balance	+563	-196	-197	-99	+426	+1,233	+1,842	+1,016

1/ Preliminary
2/ Canadian import data. Parts exports (Canadian imports) adjusted to exclude tooling charges in millions of U.S. dollars as follows: 1970-$93; 1971-$80; 1972-$85; 1973-$68; 1974-$183; 1975-$110; 1976-$43.

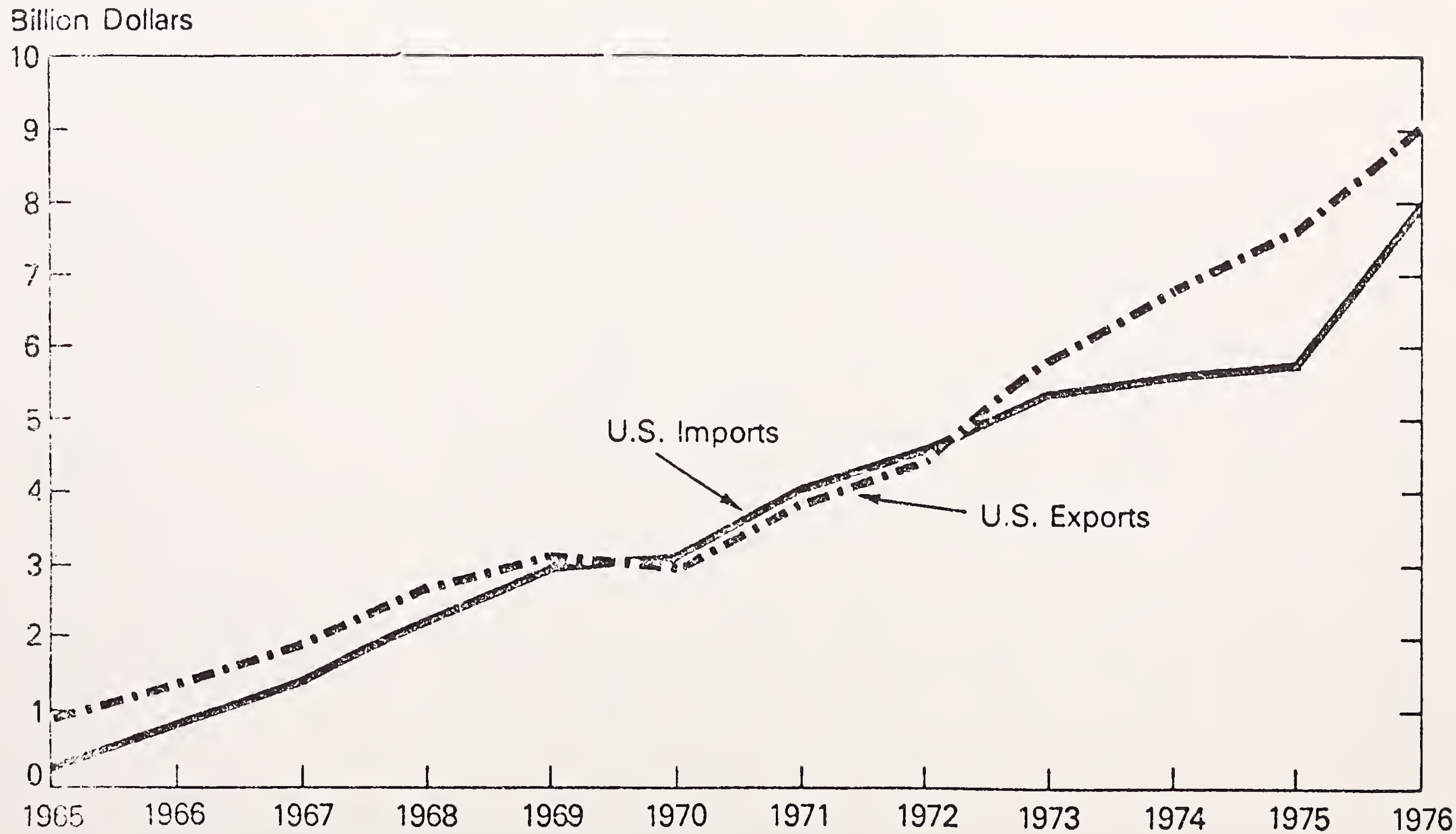
Note: Data exclude U.S.-Canadian trade in materials for use in the manufacture of automotive parts.

Data are adjusted to reflect transaction values for vehicles.
$1.00 Canadian = $0.925 U.S., 1964; $0.958 U.S., 1970; $0.990 U.S., 1971; $1.009 U.S., 1972; $0.9997 U.S., 1973; $1.02246, U.S., 1974; $.984001, U.S. 1975; $101.41, U.S. 1976.

From: U.S. Senate, Committee on Finance, Canadian Automobile Agreement, 95th Cong., 1st Sess. (1977), 13.

Figure 1

United States-Canada Trade in Automotive Products, 1965-76



Source: U.S. Department of Commerce; Statistics Canada.

From: U.S. Senate, Committee on Finance, Canadian Automobile Agreement, 95th Cong., 1st Sess. (1977), 14.

however, did invest in developing marketing organizations. Volkswagen had done so from scratch, since the mid-1950s.[105] Daimler-Benz had started using the Studebaker-Packard network. (Mercedes-Benz Sales Corporation, Inc., was a subsidiary of the Studebaker Packard Corporation.)[106] In 1965, after Studebaker decided to stop U.S. production, Mercedes-Benz of North America Inc. was formed to take over the Studebaker-Packard dealer organization.[107]

The U.S. share of world automobile production declined from about 75% in 1950 to 30% in 1970.[108] The U.S. "share" in these figures excludes cars that subsidiaries of U.S. multinational enterprises produced abroad. The U.S. share dropped not only because of the growth of European and Canadian automobile manufacture, but because of worldwide industrialization. Japan and Australia developed full-scale automobile manufacturing. Countries that had had prewar assembly operations, among them Spain, Brazil, and Argentina, started to manufacture automobiles. Nations that had never had assembly plants now insisted upon them.[109]

As the United States, Canada, and western European nations lowered tariff barriers, governments elsewhere imposed customs duties and other discriminatory measures to protect and encourage national industries. Governments in countries with infant industries pressed for local content in vehicles; import and exchange quotas became common. Around the world, subsidiaries, affiliates, and licensees of large American and European multinational corporations participated in the spread of industrialization, and competed in numerous national markets.

Thus, investments in automobile manufacture and assembly reflected and contributed to worldwide economic development. Host government regulations

provided the conditions for the creation of new "national" automobile manufacturing and assembling industries. Government was most in evidence in areas of new industrialization. Where industries were well established, tariffs and trade restrictions were reduced.

Table 6 indicates the population per car in selected countries. By 1970, western Europe had reached the level of automobile ownership prevailing in the United States in 1929; Japan was above the level of Australia, but below that of Canada in 1929; the major countries in Latin America had roughly the same ratio of persons per car as did western European countries in 1939. Elsewhere worldwide, the ratio of persons to car ownership was far higher - but the automobile was, mainly through the activities of U.S. and European multinational companies, becoming increasingly ubiquitous.

Recent Times 1968-1978

The last decade has seen an economically more integrated world automobile industry than ever in history. Manufacturing facilities proliferate. There has been a phenomenal development of Japanese automobile manufacturing. The U.S. market has become wide open to competition from abroad. Multinational automobile enterprises have expanded in size and scope; and new ones have joined their ranks. The period has seen a transformed world economy: the strength of the yen and the mark contrasts with the dollar's new weakness; the "oil crisis" has influenced the international automobile industry; government agencies provide new standards on pollution, safety, and fuel efficiency; and, once again, the postwar goals of a liberal trading system seem vulnerable to new protectionism.

The economic integration of the world automobile industry has been encouraged by the product offerings of multinational corporations that have

Table 6

Population Per Car in 1970

United States	2	Argentina	16
Canada	3	Venezuela	17
Australia	3	Mexico	41
New Zealand	3	Brazil	43
West Germany	4	Chile	56
France	4	Iran	105
United Kingdom	5	Indonesia	508
Italy	5	Nigeria	817
Japan	12	India	902

Source: Motor Vehicle Manufacturers Association, 1972 Automobile Facts and Figures, pp. 28-29.

moved away from cars, and more particularly from parts, designed for narrowly circumscribed home markets. In 1972, the European Economic Community's external tariff on passenger cars was reduced to 11%.[110] The next year the EEC was enlarged to nine nations with the entry of the United Kingdom, Denmark, and Ireland. The potential for transnational sources of supplies and markets has grown. Even countries in Europe outside the common market, Spain for example, can be involved in an integrated market. Ford's Fiesta, introduced in September 1976, is properly called a European car; it is a product of no single country.

Britain's automobile makers have been pummeled by the new competition from Continental imports in the British market. The largest enterprise in England, British Leyland, (now BL Ltd.), never developed an effective marketing organization.[111] In 1975, this ailing giant became government owned.[112] Already, by 1968-1970, the majority of the "British" passenger car

producers were owned by U.S. multinational firms.[113] British industry has become integrated into world markets, first through U.S. and now through European multinational corporate action. Indeed, the August 1978 announcement that Peugeot-Citroen (itself a merger of two large French manufacturers)[114] planned to acquire not only Chrysler's British assets (in the former British Rootes Group), but its French ones (in Simca) and its Spanish facilities, in exchange for $230 million in cash and a 15% interest in Peugeot-Citroen, represents a new and impressive integration of the European automobile industry. The plan, demonstrates the transnational character of the modern automobile industry. Peugeot-Citroen will become Europe's largest automobile company; Chrysler declared that it would participate actively in Peugeot-Citroen through its membership on the Board of Directors and "at other levels."[115] In Europe, also, Fiat is rationalizing production, as it reported in April 1978, "to reinforce the oneness of the European market both internally and internationally in order to obtain economies of scale somewhat closer to those enjoyed by [its] larger extra-European competitors."[116]

The integration of North American markets has also accelerated. In 1965, in connection with the Canadian Automobile Agreement, subsidiaries of U.S. enterprises in Canada gave the Canadian government "Letters of Undertaking to increase Canadian value added." When signed, the letters had the tacit approval of the U.S. Government. As our exports to Canada dropped below imports from Canada in 1970, the U.S. Government withdrew its tacit approval of the Letters of Undertaking; in 1977, the U.S. Government stated that the letters were not "valid instruments."[117] The consequences of the 1965 agreement have been described as a "classic case of the substitution of foreign for

domestic investment induced by tariff reduction."[118] Even though the dollar value of U.S. automotive exports to Canada has exceeded imports since 1973, the U.S. Government has been far from content with the American automobile makers' (actually their subsidiaries') contribution to Canada's efforts to build its national industry. This discontent has grown recently. Assistant Secretary of Treasury C. Fred Bergsten in August 1978 strongly condemned Canadian "subsidies" to lure U.S. and other automakers to locate plants in Canada. His remarks were provoked by that nation's requirement that Canadian duty reductions on U.S.-made Volkswagens were "conditioned on larger purchases of Canadian auto parts by Volkswagen plants throughout the world."[119]

The present-day economic integration of the automobile industry belies national identifications. The integration is not only in evidence in Europe and North America; indeed, it has been reported recently that General Motors' Asian subsidiaries were deciding whether to buy transmissions from a G.M. facility in the Philippines or from alternative company sources in the United States or Europe.[120] The decision implies an interchangeability of the transmissions that was impossible in earlier years.[121]

Worldwide in the 1970s, in industrial countries, and even more in developing ones, host governments have pressured enterprises to provide employment by raising local production and exporting. Brazil and Mexico, for example, have imposed export requirements. Multinational corporations have responded, lest they lose their competitive positions in those markets.[122] If companies export parts, there has to be interchangeability. Paradoxically, host government regulations work both for and against economic integration. The government regulations that require export promote it; those that press for local content and protection of local industry restrict it. Often the regulations are one and the same.

Worldwide, multinational companies have built new plants and created new "national" industries. Spain is developing a major automobile industry. Fiat, for example, fears competition in western Europe from eastern Europe and from developing countries; yet along with other multinationals Fiat has contributed to the emergence of these very same new automobile industries. Fiat licenses production by the Polish FSO and FSM and by the Yugoslav Z.C.Z. It produces cars in Argentina and Brazil.[123] Table 7 indicates passenger car production by country in 1977 and the population per car registered in 1976. It shows the spread of both production and consumption of passenger cars.

Table 7

Passenger Car Production-1977 in 000s of units

(In parenthesis is population per car registered in 1976)

United States	9214 (2)
Japan	5431 (6)
West Germany	3790 (3)
France	3092 (3)
Italy	1440 (4)
United Kingdom	1328 (4)
USSR	1280 (86)
Canada	1162 (2)
Spain	989 (7)
Brazil	464 (18)
Australia	369 (3)
Belgium	300 (4)
Poland	280 (27)
Sweden	235 (3)
Yugoslavia	231 (13)
Mexico	188 (25)
East Germany	170 (8)
Argentina	168 (9)

Source: MVMA Motor Vehicle Facts & Figures '78, 17, 28-31.

Nowhere has this automotive growth been greater than in Japan.[124] Japan is now second only to the United States in automobile production and first in passenger car exports. The Japanese domestic market was protected from outside competition in the 1950s and 1960s by tariff and nontariff barriers; government policy in Japan blocked foreign multinational enterprises

from scaling the barriers to trade and gaining protection behind the walls.[125] Like their European counterparts, Japanese producers built cars in a country where all the plant and equipment was of postwar vintage and thus incorporated the latest technology. Gasoline was high priced and gasoline taxes far exceeded those in the United States. The result was that most Japanese-made cars were small, light, and fuel efficient. Throughout the postwar years, the Japanese have sought to dispel their prewar image of producing cheap and shoddy merchandise. Government regulations have insisted on quality. Owing to the expansion of automobile traffic in Japan, the Japanese government in the 1970s also introduced high standards of emission control.[126]

As noted, foreign multinationals were never in the post-World War II years able to penetrate the Japanese domestic passenger car market. The recent decline in the Japanese tariff has made no difference. The entrenched domestic industry serves as an effective barrier to entry. Moreover, Japanese automotive standards provide a further obstacle to imports. In March 1978, Japan was the first nation to eliminate its tariff on passenger cars since Britain abandoned free trade in 1915. Its zero tariff compares with the 3% U.S. and the 11% European Economic Community customs tariff. The dropping of the Japanese automobile tariff, along with the recent steep rise in the value of the yen, has signaled an increase in foreign car sales in Japan. In no way, however, has there been a sizable foreign car entry.[127]

If U.S. and European multinational corporations failed to penetrate the Japanese market, this did not mean that the phenomenon of multinational enterprise was absent. Quite the contrary, Japanese-headquartered multinational business emerged. Japanese companies first produced for their domestic market. Then, they exported and invested in a marketing organizations abroad

to sustain their exports. In the late 1950s, Japanese cars began to appear on the U.S. market, and in the 1960s, Japanese firms in the United States started to integrate vertically, establishing sales and service outlets. Like Volkswagen, and like their American competitors, Japanese companies recognized it was impossible to reach the U.S. market or any foreign market without a distribution and a service network. After 1968, Japanese car sales in the United States mounted rapidly. In 1974, in units, and in 1975, in dollars, Japanese passenger car imports in the United States surpassed those from West Germany ($1.7 billion v. $1.5 billion in 1975). In 1975, Toyota sold 284 thousand cars in the United States, compared with Volkswagen's 268 thousand. That year, Japan became the world's largest exporter of passenger cars. In 1976, both Toyota and Datsun were outselling Volkswagen in the United States, and the dollar value of Japanese imports of passenger cars in the United States was $2.8 billion, compared with the German total of $1.6 billion.[128]

The opening of the U.S. market to such imports has been an important feature of the last decade. For the first time since the exceptional 1959, in 1968 automobiles from abroad (excluding those from Canada) obtained more than 10% of the U.S. market. Late in 1968, U.S. manufacturers announced they would build "subcompact" cars, which they introduced in 1970 to compete with the imports. A second generation of U.S.-made subcompacts appeared in 1974-1975.[129] By 1977-1978, U.S. industry was again heralding "new generations of fuel-thrifty automobiles."[130] Nonetheless, imports have exceeded 10% of U.S. retail sales in <u>every</u> year since 1968, reaching as high as 18.6% in 1977 (see Appendix I).

The U.S. automobile tariff has further declined from 5% in 1969 to 3% in 1972.[131] In August 1971 came the "Nixon shock," when the dollar was

devalued. The dollar was devalued again in 1973 and left to float. But it sank. All other things being equal, the effect of the decline in the dollar should have resulted in a reduction in imports, for imports became more expensive vis-à-vis domestic products. Currency declines are equivalent to tariff increases. Other things were not equal, however. In 1973-1974, the Organization of Petroleum Exporting Countries (OPEC) hiked the price of oil fourfold. There was also the Arab oil embargo. In 1974, the U.S. economy moved into a recession. Since automobile imports - despite their rising prices - remained cheaper in initial cost and more economical to operate, Americans continued to buy imports. With the recession in 1975, consumers wanted smaller cars, and imports from Japan and Europe obtained a then-record 18.4% of the U.S. market.

Among the 1974-1975 American subcompacts produced in response to these events were Ford's Pinto MPG, with a 34-mile-per-gallon rating on the EPA highway test and the Chevrolet Chevette, which was 400 pounds lighter than G.M.'s earlier subcompact, the Vega. General Motors had already produced versions of this car in Germany, Brazil, and Australia.[132]

Even with the decline in value of the dollar, in 1975 the median price at port of entry of imports from Japan and Europe was $3,000; the median manufacturers' suggested retail price for domestic cars was $4,200.[133] By 1975, imports and domestic subcompacts and compacts obtained a staggering 53% of the U.S. market.[134]

The dollar declined in value against other major currencies in 1976-1978; as a consequence, prices of U.S. imports rose; inflation and spiraling costs in Europe and Japan also contributed to higher prices for imports into the United States. Slowly, sales of imports came to be affected

by the realignment in currency values. The gap between the price of domestic cars and of imports narrowed.

In 1973, Volvo decided to build an assembly plant in Virginia to reach the U.S. market; in 1977, however, it postponed its plant in view of shrinking sales. Volvo found the competition with home-built American automobiles, captive imports, and Japanese products too rigorous.[135] In 1976, Volkswagen concluded that it had to manufacture its "Rabbit" in the United States in order to sustain American sales. Production began in April 1978, but the "Made in America" Volkswagen in the summer of 1978 was still more than 60%, including engines, made abroad.[136] Japanese companies have also reviewed the possibility of plants in the United States, and in August 1978, Toyota announced that it would build a U.S. assembly plant, while Nissan was reported to be negotiating for a plant site.[137]

Barely five months earlier, at the end of March 1978, American Motors and Renault revealed plans for joint distribution of AMC and Renault vehicles in the United States and Canada, increased imports into the United States of Renault's Le Car, and eventual production of Renault passenger cars in AMC's assembly plants.[138] In April, AMC indicated that it would assemble a medium-sized Renault car (the R18) at its Kenosha, Wisconsin plant.[139]

American multinationals varied in their approach to the new small car demand in the United States, sometimes presenting automobiles made in this country,[140] sometimes products partially made in the United States, with certain parts imported, and, on occasion, introducing captive imports.[141]

As a consequence of the sharp rise in oil prices after 1973, consumer-nation governments have been jarred into seeking means of increasing energy supplies and of limiting gasoline demand. These have ranged from

policies encouraging oil exploration and the search for alternate energy sources, to fiscal policies such as raising taxes on gasoline and progressive taxes on cars by size, weight, and engine capacity, speed limits that conserve gasoline, performance standards for vehicles, public transportation, research on different fuels for use with conventional engines, and new attention to non-conventional power trains with a variety of potential sources of energy. Each nation has developed separate responses to the oil crisis. Multinational automobile companies have reacted with new research and development expenditures, as well as changes in product and engine designs. There has been new use of lighter materials. In Europe and Japan, particularly, taxes on gasoline have soared, further encouraging fuel-efficient cars.[142]

The U.S. Government in the 1970s has imposed new standards on safety, emission control, and mile-per-gallon performance on cars sold in the United States. The last of these regulations was in response to the energy crisis. Because U.S. producers are newly burdened with government-mandated costs, their competitive position in world markets appears to have been reduced (the new costs offsetting the effects of the declining dollar). No one, however, worries much about this, for Canada excepted, the American automobile industry has almost given up reaching foreign markets through U.S. exports although, as Appendix I does indicate, exports are rising. There is some alarm in Europe over U.S. production of "European-size" cars with low fuel consumption and low pollution levels,[143] and some companies are making new efforts to export.[144] Nonetheless, the issue has arisen primarily as whether the new U.S. regulations give imports an advantage.

Government-mandated costs for American producers clearly make them less able to take advantage at home of the declining value of the dollar.

The gap between the price of imports and domestic output has not narrowed as rapidly as it otherwise would, since Americn car prices have risen annually, in part because of the costs imposed by regulations. U.S.-made automobiles appear to have needed more design changes to comply with American regulations than have imported products. Disc brakes, for example, were standard on imports in the mid-1960s. In 1965 only 2.2% of domestic automobiles had them. By the time the standard went into effect (January 1, 1976), U.S. cars had disc brakes as well, but this meant major design changes.[145] Imports have also had to introduce substantial changes to comply with U.S. safety regulations.

In March 1966, under the authority of the Motor Vehicle Air Pollution Control Act of 1965, the Secretary of Health, Education, and Welfare issued initial standards on the discharge from exhaust systems of new motor vehicles. The standards were based on the size of engine cylinder displacement, with smaller cars having less rigorous requirements. Since imports were smaller, on average, than cars made in the United States, the latter were more affected and had to undertake more extensive design alterations.

But the costs to U.S. industry related to meeting government-imposed safety and emission standards seem to have been far less, relative to imports, than the costs of complying with the requirements of the Energy Policy and Conservation Act of 1975. This act provided for annual, mandatory mile-per-gallon standards, with a fleet average of 27.5 miles-per-gallon to be reached by 1985. For decades, Europeans and Japanese have produced economy cars with mile-per-gallon performance superior to that of U.S. automobiles. As U.S. standards are imposed, American cars have required substantial technological changes, leading to reduction in size and weight, and the introduction of more

efficient engines; these changes involve high cost. To meet these new regulations means formidable capital expenditures by American enterprises.[146]

The U.S. Government has been alarmed at this country's dependence on oil imports, which, moreover, hurt the U.S. balance of payments. Reduction in gasoline consumption by automobiles is one means of stemming oil imports. Paradoxically, measures designed to cut oil imports through mandated mile-per-gallon standards have served at least temporarily to raise automobile imports.

In 1975, Congress considered legislation that would give buyers of new automobiles tax rebates and would introduce an excise tax system, both designed to encourage the production and purchase of cars with fuel-efficient engines. Congress initially rejected these proposals, at least in part because of its recognition that measures of this sort would have the effect of subsidizing imports. Moreover, a Federal Energy Administration spokesman, Roger W. Sant, testified that if the rebates were limited to domestically produced cars, this would violate Article II, paragraph 4, of the General Agreement on Tariffs and Trade, to which the United States is a party, and invite retaliatory action by our trading partners.[147] In the national energy plan of the present Administration, a "gas guzzler" tax, rewarding fuel-frugal engines was again proposed.[148] In view of the changes in the U.S. automobile industry between 1975 and 1978, such a tax, which would continue to favor imports, would probably be less harmful to U.S. producers now than in earlier years. The U.S. Department of Commerce concluded, however, that "the National Energy Program appeared to be a major factor in stimulating imported car sales by focusing attention on their fuel efficiency, which results from their smaller size and lighter weight."[149] The U.S. International Trade Commission felt the Fuel Efficiency Tax and the Fuel Efficiency Rebate in the National National Energy Act would favor Japanese imports.[150] Nonetheless,

the act, which was signed by President Carter on November 9, 1978, did contain a tax on "gas guzzling" cars to begin with 1980 models.

At least in the short run, U.S. regulations on safety, emission control, and miles-per-gallon seem easier for importers to meet than for American producers. No U.S. policy maker, however, wants the carrying out of one set of policies to cause deficits in the U.S. balance of payments by giving an advantage to car imports or worse still, domestic unemployment, by making it advantageous to produce abroad for sale in the United States.

With a world automobile industry, domestic policy measures have systemic implications. The postwar commitment by the United States to a freer, more open world economy has significant present-day consequences. Imports have stimulated competition and technological progress in the United States. In many circles in this country there is now talk of protectionism to safeguard the jobs lost through imports. The International Monetary Fund reports that in 1977 and early 1978 industrial countries made increasing use of antidumping laws and countervailing duties to offset foreign subsidies and commented that "it is often difficult to know whether such measures result from increased sensitivity to long-standing practices or whether they reflect an increased use of price-cutting actions by exporting countries. At least in their initial impact, these measures tend to have a trade retarding effect."[151]

Because the automobile industry is multinational, and because the leading American producers realize that barriers to trade would harm everyone including them, U.S. automobile makers have not asked for protection of the U.S. domestic market. By contrast, U.S. steel makers have clamored for protection, and, of course, to the extent that steel is protected, higher costs are likely to be passed throughout the economy in the form of higher automobile prices, since automobiles are large consumers of steel.[152]

U.S. Government officials have pressed, at the Tokyo Round of Multilateral Trade Negotiations, for elimination of barriers to trade, whether they be tariffs, state subsidies, government requirements that serve to distort markets, or standards that offer obstacles to commerce. The Tokyo Round has taken place in the context of worldwide fears of protectionism.[153] It is symbolic that after a steady decline in tariffs in the industrial world, it has been six years since the United States and the European Economic Community reduced their tariffs on passenger cars, although the tariffs are low at 3% and 11%, respectively.

Thus far, the main automobile imports into the United States have come from Canada, Europe, and Japan. As nations around the world develop car manufacturing, as their governments press for and subsidize exports, and their costs of production decrease, what is to be the response of the United States? Multinational automobile companies have spread technology worldwide; the automobile industry is international. National regulations imposed on an international industry seem inevitable, yet anachronistic.

In conclusion, no novelty exists in regulation of the automobile industry. Whether in the United States or abroad, government regulations of various sorts have had, and will continue in the future to have, an important influence on the industry. What is distinctive today seems to be the new and imposing impact of the particular regulatory measures concerned with safety, pollution, and especially energy on a thoroughly multinational industry. Likewise, the spectre of varying forms of trade restraint seems present and bound to create distortions in international markets. All these national regulatory actions can have unanticipated consequences, unless policy makers view them in

the context of multinational automobile enterprises operating through investment and licensing as well as trade in an increasingly integrated worldwide automobile industry.

Appendix I

U.S. Automobile Imports, Imports as Percentage of U.S. Automobile Sales, and U.S. Automobile Exports

Year	Imports (000 units) Total	Excluding Canada	From Canada	Imports as Percentage of U.S. Market (Excludes Canadian Imports)	Exports (000 units) Total	Excluding Canada	To Canada
1948	16			.5			
1949	12			.2	140		
1950	16			.3	120		
1951	21			.4	217		
1952	29			.7	141		
1953	29			.5	154		
1954	25			.5	173		
1955	57	57	*	.7	211	183	28
1956	108	108	*	1.6	175	137	38
1957**	259	258	1	3.5	142	126	16
1958	431	431	*	8.2	122	105	17
1959	668	668	*	10.2	104	79	25
1960	444	444	*	7.8	117	169	27
1961	279	279	*	6.5	104	88	16
1962	375	374	1	4.9	127	109	18
1963	409	408	1	5.1	144	136	8
1964	537	528	9	6.0	166	150	16
1965	559	530	29	6.1	106	62	44
1966	913	747	166	7.2	178	64	114
1967	1,021	697	324	9.2	280	43	237
1968	1,620	1,119	501	10.7	330	43	287
1969	1,847	1,156	691	11.7	333	41	292
1970	2,013	1,320	693	15.3	285	39	246
1971	2,587	1,785	802	15.3	387	39	348
1972	2,486	1,644	842	14.8	410	34	376
1973	2,437	1,565	872	15.4	509	57	452
1974	2,572	1,754	818	15.9	601	85	516
1975	2,075	1,341	734	18.4	640	89	551
1976	2,537	1,711	826	14.8	680	107	573
1977	2,790	1,940	850	18.6	698	106	592

* Less than 500. **Year when imports exceeded exports.

Source: 1948-1954: Imports and imports as per cent of U.S. market from Lawrence S. White, The Automobile Industry Since 1945 (Cambridge, Mass., Harvard University Press, 1971), 291, 293. Exports from George Maxcy and Aubrey Silberston, The Motor Vehicle Industry (London, George Allen & Unwin, 1959), 228. 1955-1976: Imports and exports from MVMA, World Motor Vehicle Data, 1977, 204, 203. Imports (excluding Canada) as per cent of U.S. market calculated based on registration data and data from MVMA. 1977 data from U.S. International Trade Commission, Automotive Trade Statistics 1964-77, May 1978, 2-3; and MVMA Motor Vehicle Facts & Figures '78, 7.

Appendix II

Value of U.S. Exports and Imports of Automotive Vehicles, Parts, and Engines-- 1923-1970 (in millions of dollars)

Year	Exports	Imports
1970	3,652	5,956
1969	3,888	5,346
1968	3,453	4,295
1967	2,784	2,634
1966	2,354	1,910
1965	1,929	939
1964	1,729	767
1963	1,468	586
1962	1,301	521
1961	1,188	383
1960	1,266	633
1959	1,187	844
1958	1,123	555
1957	1,349	339
1956	1,395	145
1955	1,276	85
1954	1,072	53
1953	998	53
1952	1,024	56
1951	1,218	38
1950	746	23
1949	772	13
1948	939	35
1947	1,153	6
1946	556	5
1940	259	1
1939	260	1
1938	277	2
1937	354	1
1936	246	1
1935	232	*
1934	192	*
1933	92	*
1932	78	*
1931	152	1
1930	284	2
1929	547	3
1928	509	3
1927	397	2
1926	328	2
1925	324	1
1924		1
1923		1

* Less than $500,000. Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the United States, Washington, 1975, p. 895.

Footnotes

The author wished to acknowledge the splendid research assistance of Mr. George Oberhofer. Dr. Hiroko Sakai, Messrs, James Boxall, William Krist, Stephen Merrill, and Ms. Johanna Shelton also provided information and ideas.

1. Initially, I had hoped in this paper to consider in depth the internationalization of supplier industries. Space considerations made this impossible. I am going to confine myself to passenger cars. However, the multinationalization of suppliers should be recognized as an important underlying aspect of the same activities by the car companies. For example, the German firm, Robert Bosch, produced automobile ignition systems in the United States before World War I; in 1915 the Swedish company, SKF began production in the United States of ball bearings for the American automobile industry; by the 1920s, the leading U.S. and British tire producers had foreign plants; parts makers followed. American automobile companies abroad in that decade; and so it went. Included in a recent United Nations list of major world enterprises are such suppliers of the automobile industry as ITT; the leading tire makers; Robert Bosch; Bendix; TRW; Guest, Keen and Nettlefolds; Borg-Warner; Eaton; Dana; Lucas Industries; and Budd. See Lawrence F. Franko, The European Multinationals (Stanford, Conn, Greylock Publishers, 1976), pp. 9, 164; Mira Wilkins, Maturing of Multinational Enterprise, American Business Abroad from 1914 to 1970 (Cambridge, Mass., Harvard University Press, 1970), pp. 75. United Nations, Economic and Social Council, Transnational Corporations in World Development (New York, 1978), pp. 288-311.

2. While the European Economic Community has free trade within it in automobiles national regulations still define individual markets. Thus, for example, Fiat can attribute the rise of the French share in EEC automobile production to "national policies." See Fiat, Reports of the Board of Directors, 1977 (April 1978), p. 7.

3. Mira Wilkins and Frank Ernest Hill, American Business Abroad: Ford on Six Continents (Detroit, Wayne State University Press, 1964), p. 1.

4. Allan Nevins and Frank Ernest Hill, Ford: The Times, The Man, The Company (New York, Charles Scribner's Sons, 1954), pp. 191, 194, for examples.

5. Ibid., p. 125.

6. David Landes, Unbound Prometheus (Cambridge, Cambridge University Press, 1969), p. 446, and for more details, S. Saint-Loup, Renault de Billancourt, (Paris, Le Livre Contemporain, 1956).

7. James M. Laux, "Managerial Structures in France," Harold Williamson, (ed.), Evolution of International Structures (Newark, Dela., University of Delaware Press, 1975), p. 99.

8. Wilkins and Hill, American Business Abroad, p. 10, and Mira Wilkins' contribution to Harper Encyclopaedia of the Modern World (New York, Harper & Row, 1970), p. 681.

9. U.S. Tariff Commission, Tariff Information Surveys, Automobiles (Washington, 1921), p. 7, notes that they were "chiefly high powered." This report will henceforth be cited as Tariff Commission Report-1921.

10. D. W. Fryer, World Economic Development (New York, McGraw-Hill, 1965), p. 459; Wilkins and Hill, American Business Abroad, p. 8.

11. Tariff Commission Report 1921, p. 13.

12. Cited in Wilkins and Hill, American Business Abroad, p. 9.

13. Commerce and Navigation of the United States for 1909, pp. 173, 493-494. In 1906 imports of cars were $3.8 million, and parts, $.4 million, making a total of $4.2 million. In 1907 imports of cars were $4.0 million; parts, $.8 million, totaling $4.8 million. In 1907 exports of cars were $4.9 million; parts $.6 million, totaling $5.5 million.

14. Alfred D. Chandler, Visible Hand (Cambridge, Mass., Harvard University Press, 1977) emphasizes throughout the U.S. accomplishments of economies of speed.

15. Tariff Commission Report 1921, p. 11.

16. Ibid., p. 10. In 1913 French exports were larger in dollar value than American ($45 million v. $33 million). This, of course, was due to the fact that the French exported high-priced and the Americans low-priced cars. Of the small U.S. imports in 1913, the French furnished about 50%. Ibid., p. 12. Jacques Rousseau, Histoire Mondiale de l'Automobile (Paris, 1958), p. 118, says Renault had "agencies" worldwide, including America, in the pre-World War I years.

17. Daimler Manufacturing Company, The American Mercedes (Long Island City, N.Y., 1906).

18. Louis T. Wells, Jr., "Automobiles," in Raymond Vernon, Big Business and the State (Cambridge, Mass., Harvard University Press, 1974), pp. 231, 295.

19. Friedrich Schildberger, "75 Years of Mercedes-Benz Ties with the United States," in Mercedes-Benz in Aller Welt (Stuttgart, Daimler-Benz, 1963), pp. 213.

20. Tariff Commission Report 1921, p. 13, gives tariff history.

21. Wells, "Automobiles," p. 295.

22. Tariff Commission Report 1921, p. 8.

23. Ibid.

24. Wilkins and Hill, American Business Abroad, pp. 18-20, 435, 51, 53.

25. Based on figures given in W. W. Rostow, The Stages of Economic Growth (Cambridge, Eng., Cambridge University Press, 1960), p. 170.

26. Tariff Commission Report 1921, p. 9.

27. Wilkins and Hill, American Business Abroad, p. 51.

28. Based on figures in Rostow, Stages of Economic Growth, p. 170.

29. George Maxcy and Aubrey Silberston, The Motor Industry, (London, George & Unwin, 1959), p. 99.

30. Tariff Commission Report 1921.

31. Ibid., pp. 8, 12. In 1920 the average value of cars imported from Canada was less than $700, from France $2,600, and from Great Britain $3,600! Ibid., p. 12.

32. On the price of Ford cars, see Allan Nevins and Frank Ernest Hill, Ford: Expansion and Challenge 1915-1933 (New York, Charles Scribner's Sons, 1957), p. 264; this volume and Allan Nevins and Frank Ernest Hill, Ford: Decline and Rebirth, 1933-1962 (New York, Charles Scribner's Sons, 1963) give an excellent picture of Ford and the U.S. automobile industry in the interwar period. On General Motors, see Alfred Sloan, My Years with General Motors (Garden City, N.Y., Doubleday, 1964) and Frederick Donner, Worldwide Industrial Enterprise (New York, McGraw-Hill, 1967). On the U.S. industry, in general, see Federal Trade Commission, Motor Vehicle Industry (Washington, 1939). Henceforth cited as FTC Report. Also, see Alfred D. Chandler, Jr., Giant Enterprise (New York, Harcourt, Brace & World, 1964).

33. The per capita ownership figures are based on data in Rostow, Stages of Economic Growth, p. 171.

34. FTC Report, p. 29.

35. Ibid., p. 36.

36. U.S. Tariff Commission, Summary of Tariff Information, 1929, on Tariff Act of 1922 (Washington, 1939), p. 750.

37. Nonetheless, the U.S. tariff did motivate Rolls Royce to manufacture cars in Springfield, Mass., between 1921 and 1929. Arthur W. Soutter, The American Rolls Royce (Providence R.I., Mowbray Publishers, 1976), pp. 44, 90. In 1929, a Rolls Royce executive was quoted as saying that if automobiles went on the free list, the Springfield plant would close. U.S. Senate, Committee on Finance, Tariff Act of 1929, Hearings, 71st Cong., 1st Sess. (1929), p. 828. It was, however, the prospect of new tooling expenses for the Phantom II and the stock market crash that was behind the decision to discontinue production in 1929. Soutter, American Rolls Royce, p. 118. Assembly operations continued into the 1930s. Ibid., pp. 135-137.

38. See figures in Chandler, Giant Enterprises, p. 4.

39. Alvan MacCauley, however, representing the National Automobile Chamber of Commerce and the Packard Motor Car Co., testified in 1929 that complete removal of duties might result in an "invasion of the American market by foreign made cars." Tariff Act of 1929, Hearings, pp. 823, 824, 840. Ford Motor Company came out, as it had for years, for free trade. Ibid., p. 840.

40. See Reciprocal Trade Agreements Act, June 12, 1934, PL 316, in Statutes at Large 1933-1934, 73rd Cong., 2nd sess. (1934), p. 944.

41. George Edward Domer, "The History of the American Austin and Bantam," Automobile Quarterly, XIV (1964), pp. 404-429. In 1930, 8,558 Austins were sold in the United States (Sir Herbert Austin had hoped for between 50,000 and 100,000 that year); in 1931, 1,279; 1932, 3,846; 1933, 4,726; 1934, 1,300. Ibid., pp. 417, 418, 422. "Tell me, do you get into that car, or do you put it on," was a typical response. Ibid., p. 414.

42. Tariff Act of 1929, Hearings, p. 822.

43. The quotation is from Walter Henry Nelson, Small Wonder, The Amazing Story of the Volkswagen (Boston, Little, Brown and Co., 1950), p. 31.

44. Wilkins, The Maturing of Multinational Enterprise, p. 75.

45. From Canada, Ford exported to commonwealth markets, while General Motors exported to commonwealth markets and to South America.

46. Wilkins and Hill, American Business Abroad, pp. 62-63.

47. Tariff Commission Report 1921, p. 11.

48. On the horsepower tax see ibid., p. 142, and Maxcy and Silberston, The Motor Industry, p. 49.

49. Wilkins and Hill, American Business Abroad, p. 241.

50. For this view, see Maxcy and Silberston, The Motor Industry, p. 49, and G. C. Allen, British Industries (London, Longman, 5th ed., 1970), pp. 156, 171. The argument was that Britain suffered in overseas commonwealth markets, where the standardized, high-powered large engined American cars were more appealing. For the opposite view, see R. B. McKern, "The U.S. Automobile Industry in the World Market," Raymond Vernon, Manager in the International Economy (Englewood Cliffs, Prentice-Hall, 1972), p. 439. McKern suggests that British development of light small cars with "high-efficiency" engines in response to the horsepower tax "doubtless aided British exports." This may have been true in the long run. It was not true in the short run.

51. Wilkins and Hill, American Business Abroad, p. 112.

52. Tariff Commission Report 1921, p. 14.

53. Domer, "The American Austin," p. 405.

54. See report to the Board of Directors, Ford SAF, Dec. 31, 1931, in Accession 606, Box 4, Ford Archives, Dearborn, Mich.

55. Wilkins and Hill, American Business Abroad, pp. 248-250.

56. Harper's Encyclopaedia, p. 755.

57. See letter from Maurice Dollfus to C. E. Sorensen, Feb. 4, 1936, Accession 38, Box 32, Ford Archives. In March 1936, Dollfus was writing Sorensen (March 25, 1936 in ibid.), "I should mention that the fact that our present frame is American is a handicap, both from the point of view of cost and from the point of view of 'nationalization' of our product. Besides we shall probably not be permitted to import frames in 1937."

58. Wilkins pp. and Hill, American Business Abroad, 138, 207.

59. Ibid., pp. 233, 232, 247.

60. In June 1931, to cover part of the serious German deficit, a heavy tax had been placed on gasoline (E.C. Heine to F. S. Thornhill Cooper, June 9, 1931, British Ford Archives, Langley, England). There was also a steep tax on new cars registered. On Hitler's speech see Wilkins and Hill, American Business Abroad, p. 270. Nelson, Small Wonder, p. 29, says that Hitler in this 1933 speech proposed a popular car. The reports that we have read of the speech do not indicate this.

61. Wilkins and Hill, American Business Abroad, p. 272; Volkischer Beobachter, March 9, 1934; New York Times, March 9, 11, 1934. Nelson, Small Wonder, p. 35, puts this 1934 show in January; it was in March.

62. On German car registrations, see data in Accession 507, Box 95, Ford Archives.

63. Quoted in Wilkins and Hill, American Business Abroad, p. 248.

64. Based on figures in Rostow, Stages of Economic Growth, p. 171.

65. Wilkins and Hill, American Business Abroad, pp. 124-128.

66. U.S. Department of Commerce, Bureau of Foreign and Domestic Commerce, The Automotive Market of Australia (Washington, 1929), pp. 1-2.

67. Mira Wilkins, "The Role of U.S. Business," in Dorothy Borg and Shumpei Okamoto, Pearl Harbor as History, Japanese-American Relations 1931-1941 (New York, Columbia University Press, 1973), pp. 360-361, and Mira Wilkins, "American-Japanese Direct Foreign Investment Relationships 1930-1952," 1978 typescript, publication forthcoming.

68. FTC Report, p. 36.

69. Stephen D. Cohen, The Making of United States International Economic Policy (New York, Praeger, 1977), p. 29.

70. Wilkins and Hill, American Business Abroad, p. 364.

71. Allen, British Industries, pp. 171-172.

72. Maxcy and Silberston, The Motor Industry, pp. 17, 228.

73. Wilkins and Hill, American Business Abroad, pp. 363, 365, 381, 382.

74. Allen, British Industries, p. 158.

75. Maxcy and Silberston, Motor Industry, p. 228.

76. Allen, British Industries, p. 157.

77. Franko, European Multinationals, p. 103.

78. Nelson, Small Wonder, p. 332.

79. Wilkins and Hill, American Business Abroad, p. 368; Nelson, Small Wonder, pp. 3-4.

80. Nelson, Small Wonder, pp. 117, 121.

81. Ibid., pp. 140-147, 172, 174.

82. Maxcy and Silberston, The Motor Industry, pp. 223, 227, 228.

83. Compare Nelson, Small Wonder, p. 332, and Allen, British Industries, p. 178.

84. Wells, "Automobiles," p. 234.

85. Ibid., pp. 238-239.

86. Nelson, Small Wonder, passim and Wells, "Automobiles," pp. 239-241.

87. The 17.6% went into effect July 1, 1968. Data from EEC Washington office.

88. Wells, "Automobiles," 246.

89. McKern, "The U.S. Automobile Industry," pp. 445, 447; Motor Vehicle Manufacturers Association, 1972 Automobile Facts and Figures, p. 67.

90. Wilkins, Maturing of Multinational Enterprise, p. 404.

91. G.M. and Ford expanded their prewar German manufacturing. Ford sold its French plants to Simca; Chrysler by 1963 had obtained control of Simca.

92. Motor Vehicle Manufacturers Association, Facts and Figures 1977, p. 18.

93. Nevins and Hill, Ford: Decline and Rebirth, p. 333.

94. Lawrence J. White, The Automobile Industry Since 1945 (Cambridge, Mass.: Harvard University Press, 1971), p. 182.

95. Wilkins, Maturing of Multinational Enterprise, pp. 335-336.

96. White, The Automobile Industry, p. 294.

97. Appendix I reflects the rise of imports 1950-1959 and their decline 1960-1961.

98. White, Automobile Industries, p. 185.

99. Based on incremental increase in Volkswagen registrations, given in Nelson, Small Wonder, p. 333.

100. 1972 Automobile Facts and Figures, p. 41.

101. Harbridge House, The Imported Automobile Industry (Boston, Harbridge House, 1976), p. 44.

102. Tariff schedule from International Trade Commission, Washington, D.C.

103. U.S. Senate, Committee on Finance, Canadian Automobile Agreement-Eleventh Annual Report (Washington, 1977), gives good details on the pact and includes a copy of the agreement. Quotation is from p. 3.

104. Duty-free import privileges in Canada (but not in the United States) were limited to vehicle manufacturers; individual Canadians, who imported U.S.-made cars had to pay a 15% ad valorem tariff. The Canadian regulations have resulted in the persistence of higher car prices in Canada than in the United States.

105. Nelson, Small Wonder, chaps. 8-10.

106. Mercedes-Benz in Aller Welt (Stuttgart, Daimler-Benz, 1963), p. 222.

107. Data on the takeover from W. R. Stinnette, Mercedes-Benz of North America, Jacksonville, Fla., August 29, 1975. Studebaker had about 1,200 dealers; Mercedes-Benz terminated all except 300. White, Automobile Industry, 17, indicates Studebaker announced it would stop U.S. production in March 1966.

108. 1972 Automobile Facts and Figures, p. 66.

109. American Manufacturers Association, 1971 Automobile Facts and Figures, pp. 12-13 (world production and assembly).

110. Data from EEC office, Washington, D.C.

111. Derek F. Channon, The Strategy and Structure of British Enterprise (Boston, Graduate School of Business Administration, Harvard University, 1973), p. 109.

112. Economist, August 16, 1975, p. 71.

113. Channon, Strategy, pp. 105-109.

114. On the Peugeot-Citroen Merger of 1976, see excellent article in New York Times, June 5, 1977.

115. Details in Wall Street Journal, August 11, 1978.

116. Fiat, Reports of the Board of Directors 1977 (April 1978), p. 8.

117. Canadian Automobile Agreement, p. 5.

118. C. Fred Bergsten, Thomas Horst, and Theodore H. Moran, American Multinationals and American Interests (Washington, Brookings Institution, 1978), p. 88.

119. Statement by C. Fred Bergsten before U.S. House of Representatives, Subcommittee on International Trade, Investment, and Monetary Policy, August 1, 1978.

120. Bergsten, American Multinationals, p. 384.

121. For future of economic integration see "The Auto Clash Goes Global," Dun's Review, April 1978, pp. 49-53.

122. The Brazilian export program is voluntary, but linked with local content requirements; there are major advantages to the manufacturer that participates. In Mexico, 60% of the value of imported production material must be compensated for by exports of equal value; in 1979, the figure increases to 100%. Data from U.S. Department of Commerce, September 1978. See Bergsten, American Multinationals, pp. 422-423, for some of the implications. Note the measures of Canada toward Volkswagen are not unlike those of less developed countries.

123. Fiat, Reports to Board of Directors 1977, p. 24.

124. M. Y. Yoshino, Japan's Multinational Enterprises (Cambridge, Mass., Harvard University Press, 1976), p. 65, indicates the rise in production from 100,000 units (1951) to 5 million (1970). In 1977, Japan produced 5.4 million passenger cars per year. MVMA, Motor Vehicle Facts & Figures '78, p. 17, for 1977 figure.

125. In the 1950s, Japanese producers did obtain licenses to assemble British and French models (those of Austin, Rootes, and Renault) and thus gained experience with small cars. See Yoshi Tsurumi, The Japanese are Coming (Cambridge, Mass., Ballinger, 1976), p. 23.

126. Harbridge House, Boston, Massachusetts, has conducted an excellent research study for the U.S. Office of Technology Assessment. The report has fine data on air pollution regulations in Japan. Henceforth, I will cite this initial draft of the unpublished Harbridge House study as "Harbridge House Study 1977."

127. Wall Street Journal, August 7, 1978.

128. Figures from Motor Vehicles Manufacturers Association, 1975 Automobile Facts and Figures, p. 61, and Motor Vehicle Facts & Figures '77, p. 81. See Automotive News 1977, p. 70 (on level of imports by make). In 1976, the number of Japanese car imports (1.1 million) exceeded the number of Canadian car imports (825,000), although the dollar total of U.S. imports from Canada was still higher than from Japan. MVMA, Motor Vehicle Facts & Figures '78, p. 81.

129. Harbridge House, Imported Automobile Industry, pp. 34, 36.

130. MVMA, Motor Vehicle Facts & Figures '78, p. 2.

131. Data from International Trade Commission, Washington, D.C.

132. Harbridge House, Imported Automobile Industry, p. 36.

133. Ibid., p. 43.

134. Ibid., pp. 37-38.

135. On Volvo's experience, see European Community, July-August 1978, p. 10.

136. Ibid., pp. 11-12; Miami Herald, April 9, 1978. Wall Street Journal, August 22, 1978, gives the 60% figure. Earlier anticipated figures were 30%.

137. Honda decided to assemble motorcycles in Ohio, Miami Herald, October 12, 1977. It indicated it might start U.S. manufacture of cars in "several years." See ibid., August 29, 1978, on Toyota plans, and ibid., September 1, 1978, on Nissan's negotiations with Baltimore and Maryland officials.

138. Miami Herald, April 1, 1978, and Wall Street Journal, April 3, 1978.

139. Miami Herald, April 14, 1978.

140. The Energy Policy and Conservation Act of 1975 defined a domestically manufactured car as at least 75% of the cost made in the United States or Canada.

141. On captive imports, 1964-1976, see U.S. International Trade Commission, Automotive Trade Statistics, Series B., USITC Publication 839 (Washington, October 1977), pp. 66-68 and 30-32.

142. Economic Report of the President, 1978, p. 187. The "Harbridge House Study 1977" is detailed and extremely useful on these approaches. According to this study, prices per gallon of regular gasoline at the pump (January 31, 1977) equaled $2.11 (Italy), $1.63 (France), $1.43 (West Germany), and $1.14 (England).

143. See Fiat, Reports to Board of Directors, 1977 (April 1978), p. 8. When in the inter-war period, the British horsepower tax forced the redesign of British engines, British economists thought this made the car less competitive in world markets, see above; likewise, the general consensus now is that the added costs of regulation make the U.S. car less competitive, but can it be that the new designs will be more suitable in export markets?

144. Occasionally, there seem to be export opportunities - to Saudi Arabia, for example. The issue of increasing exports is frequently discussed. When I mentioned my pessimism to a U.S. Department of Commerce representative, he disagreed. The U.S. Department of Commerce has been pressing U.S. companies to export. But, U.S. exports of passenger cars, excluding those to Canada, were less than 1.2% of U.S. production in 1977. Based on data from Appendix I herein and MVMA, Motor Vehicle Facts & Figures '78, p. 8.

145. Harbridge House, Imported Automobile Industry, p. 42.

146. On this, see for example, 1975 Automobile Facts & Figures, p. 6.

147. See testimony of Roger W. Sant, Assistant Administrator for Conservation and Environment, Federal Energy Administration, U.S. Senate, Committee on Commerce, Automobile Fuel Economy and Research and Development, Hearings, 94th Cong., 1st sess. (1975), pp. 112-113.

148. Economic Report of the President 1978, p. 192.

149. U.S. Department of Commerce, 1978 U.S. Industrial Outlook (Washington, January 1978), p. 148.

150. U.S. International Trade Commission, Fuel Efficiency Incentive Tax Proposal: Its Impact Upon the Future of the U.S. Passenger Automobile Industry, Report to U.S. Senate, Committee on Finance, 95th Cong., 1st sess. (1977), p. 4.

151. IMF Survey, August 14, 1978.

152. Finance and Development, September 1978, pp. 14-15.

153. See ibid.

CONCLUDING REMARKS:

REGULATION AND INNOVATION IN THE

AUTOMOBILE INDUSTRY

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For the last day and a half, the participants in this symposium have been talking about the relationship between technology, Government, and the future of the automobile and its industry. I would like to focus on one aspect of technology -- innovation -- by taking a look at the stimuli for innovation within the automotive industry, and what role the Government has played in pressing for the application of technological innovation toward socially-responsible goals.

Innovations can be brought about by two fundamental mechanisms -- a demand for them, or the irresistable attraction of new ideas. These are traditionally referred to as market pull and technology push, but those terms are too limited to describe the range of conditions that can bring about innovation.

There are at least six forces that influence the rate of auto industry innovation as well as its focus, and often they interact dynamically with each other:

- Internal stimulus
- Market structure
- Inventions
- Independent research
- Public expectations or crises
- Government regulation.

Internal Stimulus

It is important to distinguish between innovation that is needed to fulfill consumer health and safety rights and the kind of innovation that has dominated the auto industry since the 1930's. In industrial automation, styling and promotion, the auto industry has been quite innovative. But this has not been the case with the subject of all these efforts -- the operating motor vehicle itself. Most insider suggestions concern better ways to cut costs and increase productivity. This is where the real incentives are found.

Electronic Assisted Scheduling is cited by William Abernathy[1] in one of his case studies as a continuing area of innovation allowing better utilization of plant, inventory, and labor in the automobile production system while not compromising the variety of offerings or flexibility in production scheduling. It developed out of both technological push in the electronics industry which has expanded explosively in the last forty years, and market pull by the automobile manufacturer as customer.

This concept is typical of the industry's bread-and-butter innovations: those that reduce cost and promote productivity for the manufacturer as opposed to product innovations that reduce harm or provide other benefits for the purchaser. The industry, as customer for innovative changes, eagerly looks for those that can reduce the cost of building cars and increase the profits and stability of the industry. In recent years, the use of computers for virtually all aspects of the automobile business has vastly increased its design options, the speed and thoroughness with which tasks can be completed, and has reduced costs.

An article in Fortune Magazine in June 1956 entitled "How Strong is GM Research?", concludes:

> "Despite the glitter of its new technical center, GM has not yet proved that it has a research laboratory of front rank. Until very recently Detroit had never done much research as scientists understand it. Most of its so-called research achievements have fallen rather under the heading of advanced engineering."

Paul Chenea, Vice President in charge of General Motors' research laboratories, acknowledged as much in his speech, "Innovation, Maturation, and the Automotive Industry,"[2] in which he talked about the evolutionary nature of auto industry innovation. While suggesting that innovation has not declined in Detroit as it does in most industries as they mature, he hastened to point out the barriers: "Making even incremental innovations in automotive subsystems, which have undergone many generations of major design cycles, requires massive investments in technical manpower and facilities."

Professors Nelson, Peck and Kalacheck, in Technology, Economic Growth and Public Policy,[3] are cited in a paper by Professor Mark B. Schupack of Brown University in the 1968 Senate hearings on competition in the automobile industry[4] as pointing out that the auto industry investment in research and development is a very small percentage of its sales. They suggest that, with no size or institutional barriers, the auto industry's superficial product differentiation barrier may well dictate the limits of auto industry research.

Lawrence White, in his chapter in Walter Adams' book, Structure of American Society,[5] suggests that since World War II, the big auto companies have tended to rely for advances in technology on their suppliers who have done much of the pioneering development work on new items like power steering and brakes,

ball joints, alternators, and transistorized ignitions. While competition among suppliers has been one stimulus for innovation in the automobile industry, the direction of supplier research and development is fairly rigidly constrained by the priorities of the giant manufacturers. Also, many new items were first used on European cars before the American companies decided to adopt them. The materials suppliers -- steel, aluminum, glass, plastics and paint companies -- have done the development work in this area according to White, who points out that the manufacturers have pushed the suppliers to take the risks and absorb the initial costs of developing new technology.

While there are some exceptions, all of these factors suggest that historically the domestic automotive manufacturers have had little internal stimulus since the 1920's for development of motor vehicle innovations, and particularly ones concerned with so called externalities -- that is, health and safety items of concern to car users or the public generally but of little concern to manufacturers who suffer no harm from their absence.

Market Structure

One of the continuing debates about the automotive industry is whether the huge size of the companies is conducive or harmful to product innovation. The case has been argued that the stability and resources of these large companies fosters broad-scale research opportunities and enhances the possibilities for technological breakthroughs. On the other side, it is argued that the oligopolistic structure of the industry and its resulting non-competitive conduct inhibits new ideas or any activity which might rock the boat. One might recall Judge Learned Hand's description of "the quiet life" of the monopolist.

Scherer, in his basic text Industrial Market Structure and Economic Performance[6], argues that large company size does not inspire creativity and innovation. He points out that the early, most imaginative steps in the innovative process require relatively small resource commitments, and that the heavy financial commitments do not come until full-scale development begins. He cites approvingly the 61 case histories compiled by Jewkes, Sawers and Stillerman[7] of important 20th Century inventions showing that less than one-third came from industrial research laboratories. Subsequently, Hamberg investigated 27 major inventions introduced in the 1946 through 1955 decade and

found only seven originally conceived in large industrial laboratories while 12 were traced to independent inventors.

Scherer concludes that huge or tiny firms, for different reasons, are not the most conducive to innovation. "All things considered, the most favorable industrial environment for rapid technological progress would appear to be a firm size distribution which includes a preponderance of companies with sales below $200 million," he said, "pressed on one side by a horde of small, technology-oriented enterprises bubbling over with bright new ideas, and on the other by a few larger corporations with the capacity to undertake exceptionally ambitious developments."

Consistent with this conclusion is the Office of Management and Budget assessment of the Federal responsibility in assuring support of small business through the contracting and procurement process.[8] Their interest is focused on the fact that "there is considerable evidence that the small proportion of Federal research and development work that is being awarded to small technology-based firms is contributing to a serious loss of high technology capabilities to our Nation." A background paper prepared for the OMB stated:

> "Many analysts believe that small firms have a better record for innovation than large firms... Some believe that managers of small R&D firms have a greater incentive to innovate while conversely, in some cases, the marketing plans of large firms dictate that technical improvements to their products be held to a minimum. There also is a possibility that researchers in large firms tend of overspecialize to a greater extent than researchers in small firms. Mr. Rabinow has observed that, 'when one narrows his specialization, he probably comes up with fewer ideas. If one loads the dice in favor of a certain art, one cuts off analogous arts... The more an inventor can pull out of related and unrelated arts, the more original his ideas are likely to be'."
>
> "Empirical evidence indicates that in a comparison of firms with less than 1,000 employees and those with over 1,000 employees:
>
> - Firms with less than 1,000 employees accounted for almost one-half of major U.S. innovations during 1953-73.
>
> - The ratio of innovations to sales is about one-third greater in firms with less than 1,000 employees.

- Firms of less than 1,000 employees have a ratio of innovations to R&D employment which is approximately four times greater.

- The cost per R&D scientist or engineer is almost twice as great in firms of over 1,000 employees."

As applied to the automotive industry, economist William Shepherd, in Market Power and Economic Welfare,[9] suggests that the two primary sources of shared monopoly -- the model year change and the dealer-franchising policies -- are disincentives to innovation. White points out that with price competition "muted," the manufacturers have focused their attention in rivalry for sales in non-price areas, such as the annual model change which also serves as a method of encouraging faster replacement and larger sales. As adopted by the automotive companies, the annual model change has consisted primarily of superficial frills and style rather than technological or significant engineering changes, a logical strategy if the objective is minimum risk and cost. The industry had learned how to promote style and design but had not attempted to convey to consumers any sophisticated information regarding automotive technology.* With consumers having a difficult time at best judging the merits of technological advances, the decision was made long ago to promote sales based on what the customer could see and feel.

In addition, with technology advances always uncertain, and the lead time constraints for mass production unyielding except at a large cost, the manufacturers long since abandoned this form of product competition. Having found a successful sales strategy which increased the barriers to entry by competitors, the companies shunned any mention of improvements which might ameliorate the so-called "externalities" -- health and safety damage. They even claimed that any mention of them might scare customers away! In addition, the cost of the styling and annual model year change -- variably estimated at from $200 to $700 in pre-1970's inflation dollars -- used precious resources in non-productive ways.

*The Congress in 1972 recognized this failing and instructed the National Highway Traffic Safety Administration to develop comparative consumer information by make and model on crashworthiness, damageability and repairability. Funding was recently acquired (for fiscal year 1979) to begin this task.

Another explanation for the slow rate of auto industry innovation is the absence of stress in an oligopolistic industry to compete for a position in the marketplace. In a rare public appearance for a chief auto industry executive, George Romney in 1958 told the Kefauver Antitrust and Monopoly Subcommittee hearings on Administered Prices:[10]

> "Let me say this, Senator: that if you want to keep an industry out of a rut, have enough companies in it so that some of those companies have got the sheer necessity of invention. When you get down to a few -- and they are all prospering -- millionaires and billionaires don't pioneer."
>
> * * *
>
> "Mr. Curtice [of GM] has pointed out that above a reasonable minimum, size itself is not an important factor in the ability of a company to compete effectively. This is absolutely true, but there continue to be persistent illusions about the importance of size."
>
> "Incidentally, those illusions are promoted and furthered and there is practically a concerted campaing going on in the United States today among the biggest companies in the land to further the illusion that size is an inherent advantage in terms of product value, and it is not true, but it is designed to increase the competitive handicap and difficulty of smaller companies secondarily; primarily, to meet the public concern about this problem of size and economic concentration."
>
> * * *
>
> "What I am saying to you is that the product competition in the United States hasn't been sufficient to result in developing automobiles in this country which would permit people to make a free choice from the types of automobiles that people are using ..."

Two examples indicate how the lack of internal incentive and the fact of external peer pressure can frustrate innovation in health/safety developments in this highly concentrated industry. In 1956, Ford decided to offer a "safety package" to the public consisting of the deep dish steering wheel, padded dash, and safety belts. But it dropped all advertising within several months of the beginning of that new model year because of fears expressed by other companies -- primarily General Motors -- that discussing safety items would take away customers from the industry as a whole.

In 1969, the Justice Department charged the four American auto companies with conspiring to restrain the development and use of vehicle pollution controls.[11] The memorandum supporting the case disclosed that Chrysler yielded to pressure from Ford and General Motors by not installing its Cleaner Air Package emission control system although it was ready to be put on 1965 model cars. The two giant companies apparently intended to continue their opposition for 1966 models until it became evident that Chrysler's California certification was going to be granted.

<u>Inventions</u>

Auto industry executives have recognized the slow pace of innovation in their industry and the need for engineering progress. More than a decade ago Henry Ford II acknowledged:

> "When you think of the enormous progress of science over the last two generations, it's astonishing to realize that there is very little about the basic principles of today's automobile that would seem strange and unfamiliar to the pioneers of our industry ... What we need even more than the refinement of old ideas is the ability to develop new ideas and put them to work."

Yet the frustrated inventors who never penetrate the bureaucracy of the auto industry are legion. The Government itself has given short shrift to inventors of safety and emission equipment although occasionally one breaks through the public consciousness through sheer persistence, the interest of a news reporter, or an appearance at Congressional hearings.

The auto industry has been plagued by the NIH (Not Invented Here) syndrome from its early days. The companies do not like to pay royalties to inventors and have been known on more than one occasion to review an inventor's patent and subsequently develop quite similar products on their own -- leaving the small inventor the alternative to sue a company with resources he could never match. On other occasions, the companies have been charged with purchasing an invention and placing it on the shelf.

With venture capital hard to come by for final development and production of an invention, and with a gross imbalance in size and resources between the manufacturers and almost any of the suppliers, there has always been a master/servant relationship between the auto manufacturers and the companies

or on occasions individuals who provide much of their technological capability. More than one company -- and some after servicing the industry for years and years -- has been virtually broken by a decision to discontinue their product. Indeed, when controversial auto industry matters arise in the regulatory/ Congressional arena about whether a certain development is feasible and practicable, the suppliers, with a few exceptions, remain silent for fear that stepping out of line might cost them business. The economic pressure of such a relationship is immeasurable and it clearly has silenced some proponents of readily available product improvements from stepping into the public limelight.

Independent Research

Research by independent organizations and the Government can stimulate innovation within the industry in several ways. First, such work can identify critical problems that should be addressed in the design or construction of automobiles. Second, independent R&D can develop new concepts or hardware to solve problems.

Prior to the enactment of the auto safety statute, the prime institutional research outside the auto industry was conducted by the Public Health Service in HEW. The HEW grant program funded individual researchers who were interested in a particular aspect of vehicle or highway safety. There was little coordination among the different grantees, but there was a small body of expertise built up in the 1950's and early 1960's which was crucial in the debate for enactment of the present law. The auto industry with HEW also funded some work during the 1950's at several independent laboratories, such as Cornell Aeronautical Laboratories and the Harvard School of Public Health, on crash injuries. But this work was virtually unknown to the public at large and thus did not challenge the auto industry's refusal to give priority to safety in its products.

Liberty Mutual, and then New York State (under legislation passed by State Senator Edward Speno) developed prototype or experimental safety cars but the work was either not completed or had little impact by the time the new statute was enacted. However, this work did play a major role in the requirement now in law that the NHTSA must develop experimental safety vehicles -- in essence, hardware to challenge traditional industry concepts.

The early experimental safety vehicle program work was crude, and the auto industry made a mockery of it. In the early 1970's, they contracted with the Department of Transportation for $1 to produce their own experimental

safety cars. They created goliaths that weighed in at 5500-plus pounds, one of which was made of such esoteric materials it could not be mass produced. In other words, a safer car cannot be made.

The Department turned to the foreign governments and industry to do what the domestic industry would not. A number of foreign countries with their industries produced first-rate experimental safety vehicles -- mostly weighing between 2,00 and 3,000 pounds -- which were designed to crash without severe injury or death at 40 to 50 miles-per-hour. They showed that it could be done -- with a small car -- and thus gave new credibility and self-confidence to the experimental vehicle program.[12]

The next step - and one still in progress - was the development by the Department of Transportation of attractive, light-weight experimental cars that could be used as the basis for rulemaking activity to push the state-of-the-art beyond the basic minimum set in the 1967 standards and still in effect today. Two new vehicles are just being completed -- one quite close to the state-of-the-art of present manufacturing but significantly exceeding the safety characteristics of presently produced vehicles, and the other a new concept vehicle whose production would require industry to initiate some retooling. Both are small in weight, high in fuel economy, and with 40 to 50 mps crash survivability characteristics.

Their purpose is to show the public and the industry that it can be done, that far safer and fuel efficient vehicles can be manufactured that are attractive and appealing to the public.

Other outide institutional research that has played a role in challenging traditional auto industry mystiques has been done by the Insurance Institute for Highway Safety since it has been headed by Dr. William Haddon, Jr., M.D., beginning in 1969. The Institute has played a major role in pushing for reduction in vehicle damageability, in developing an independent data system based on insurance industry information, in discovering and calling for the recall of defective vehicles, particularly those that are badly designed, and in researching and toppling some of the traditional beliefs in automotive and highway safety.[13]

In addition to showing affirmatively that certain health and safety measures can be readily built into cars, the institutional research outside the auto industry pushes the companies to look further into the future rather than

focus as they too often do on the next several years. Although the industry constantly reminds the Government of its lead time needs -- three years-plus is the usual request -- the industry itself has rarely looked very far into the future of advanced technology application, particularly to improve societal needs in motor vehicles. But outside research can do little more than show the way. Absent public recognition and demand, it is merely another possibility -- and often one to be ignored.

Consumer Expectations

Consumer expectations for the design of vehicles to meet societal goals have matured significantly in the last ten to twelve years. The major example of consumer impact on vehicle design came with the oil embargo in late 1973 and its influence on the industry to improve fuel economy which had been dropping steadily for years as the companies made bigger, faster cars in the eternal search for something new -- other than new technology. The drop in auto sales and the gasoline lines jolted an industry used to stability and evolutionary changes. It introduced the era of the downsized car, and the opportunity for other cost-reducing innovations.

Since my colleague, Michael Finkelstein, has dwelt at length with the issues of consumer expectations and the need for technical consumer information about vehicle safety, I will not pursue that further except to say we certainly know from the Pinto and Firestone experience that the public won't buy automotive items they perceive to be hazardous, and we know from surveys of public opinion such as the Hart survey[14] and others[15] that the public says it wants greater safety built into cars. The key question is whether this interest will be reflected in marketplace demand if the Government supplies technical information to consumers or whether it will only happen if a manufacturer decides to break ranks and produces and sells its safety innovations.

Federal Regulations

In the last decade, a major new factor, Federal regulation, had had a substantial influence on the priorities and the performance of the auto industry. The primary purpose of Federal regulation is to set minimum levels of performance in safety, fuel economy, and emissions that must be met by all cars sold in the U.S. In each case, the regulations have forced a new look at the basic technology of the motor vehicle:[16]

- Safety standards have caused body designers to include crash integrity as an integral factor in the design of frame and body structures. This includes providing a fairly rigid passenger compartment with occupant restraints, energy absorbing interior padding and exterior structures, and safety packaging of the fuel system.
- Emissions control standards have forced engine designers to re-think the fundamental technology of the internal combustion engine as well as the design tradeoffs that had been conventionally made in engines. It also stimulated a substantial amount of work on alternative engine technologies.
- Fuel economy standards have resulted in a complete re-thinking of the basic design parameters of automobiles -- from special layout and drivetrain configuration to materials and fabrication techniques.
- Regulations, in general, encourage innovation in areas where the market demand is unclear. If manufacturers believe safety does not sell, they will be reluctant to risk innovations in that area, believing they will have a price disadvantage if they do. By levying uniform standards on all companies, this risk is eliminated and the manufacturers are challenged to find the least costly way to achieve the performance required.

These Federal regulatory programs are stimulating a level of product innovation that has not been seen since the early days of the industry. And the direction of that activity is no longer only toward near-term marketing objectives such as style and luxury options, but rather it is addressing the serious social, environmental, and resource problems that plague the automobile transportation system.

A secondary benefit, however, has been to stimulate and to advance the art of automotive engineering. The adoption of computers for virtually all aspects of the automobile business has resulted from the need to meet Federal requirements without compromising the traditional performance and value of passenger cars. These requirements have also introduced new levels of rigor into the engineering and testing of vehicles, which now must meet objective performance standards, not just best guess evaluations of perceived consumer desires.

One of the unfortunate side effects of minimum Federal standards is that they are often treated as maximum standards by this monolithic industry. In such a case, they tend to define a state-of-the-art and are used as an excuse to avoid further innovation in that aspect of the vehicle once the standard is met. The Department of Transportation is attempting to address this difdiculty in the future by promulgating technical consumer information requirements that can help make safety, damageability, and maintainability marketplace factors. Competition among automobile manufacturers to achieve high consumer ratings could stimulate further innovation in these areas.

Despite the continuing industry complaints about current regulations, it is quite clear the industry leaders recognize that regulation has had a salutary effect on innovation in the last several years as we prepare for the new models of the 1980's. Numerous industry spokesmen have adknowledged this.

Mr. Charles Heinen, Director of Vehicle Emissions at Chrysler, is an example:

> "Much as I hate to admit it, the EPA accelerated the pace at which we studied combustion. The knowledge we've gained is important, whether applied to emission control or fuel economy."[17]

Henry Ford II was even more direct:

> "...We wouldn't have the kinds of safety built into automobiles that we have had unless there had been a Federal law. We wouldn't have had the fuel economy unless there had been a Federal low, and there wouldn't have been the emission control unless there had been a Federal law." [18]

Among those who are delighted with the challenges from the regulations of the 1980's are industry engineers. For them and the public for the first time in four decades the "new" in the new model year will refer to new technology and it will be primarily by engineers, not stylists. The engineers are excited. Listen, for example, to Robert B. Alexander, Vice President, Car Product Development Group, Ford Motor Company, who said last year:

> "...the lion's share of the burden of meeting these stringent standards and mandates will fall on the shoulders of the engineers. In fact, I like to call this the 'age of the engineer' -- and I, for one, couldn't be happier."[19]

Or hear the words of Stuart Frey, Chief Vehicle Engineer, Car Engineering Group, Ford Motor Company, who said in August:

> "...let me say that the task ahead is the kind that an engineer relishes because it puts a premium on ingenuity and creativity. I believe I speak for all of my colleagues in the industry when I say I'm delighted to be part of the action."[20]

The vehicle manufacturing industries are experiencing a renaissance, driven substantially by Federal regulation, taking them from the era of seat-of-the-pants engineering toward the technological forefront of American industry. And this revolution is producing not only direct benefits in the performance of the product, but also significant fallout in improved productivity, enhanced ability to compete in the worldwide automotive market, and a new professional standing for the automotive engineer.

Future Trends

The question now is whether, given this renewed regulatory stimulus, the climate is such that the innovations needed for the future will flow in sufficient volume to meet the increasing challenges of the future. Or will the manufacturers stonewall the public, hold suppliers hostage, and refuse to apply their genius and capability for the public's benefit? Will materials be developed that can make the gas turbine or the Stirling engine a reliable, low cost engine for the cars of the late 1980's and the 1990's? Will we continue to have the kinds of technological inventions that will allow the U.S. to take advantage of the favorable exchange rates, making the new American-built motor vehicles highly competitive on the international market?

There is a trend that bodes ill in this respect: the overall reduction in the commitment of resources by the country to civilian research and development. This problem has occurred both in industry and in Government. Our current budget for motor vehicle research and development is about $21 million, or approximately 5 hours of GM's gross revenue. While the deaths and injuries continue to climb, the funds available for safety research have decreased nearly $3 million since 1975, and inflation has reduced our purchasing power by another 25 percent. The funds first allocated in 1977 for fuel economy research have remained level ever since. Similarly, although the industry has committed a large amount of capital to programs to meet Federal fuel economy requirements in the short term, the commitment of the industry to longer term research and development for safety, fuel economy, and emissions is tiny, and follows the trends of U.S. industry generally toward very short-term horizons.

Another factor that discourages innovation is an economic climate of boom-and-bust cycles. High inflation rates usually discourage investments in the generation of ideas and inventions that are needed for longer-term innovations and changes. High interest rates that result from inflation cause some manufacturers to shorten even more their time horizons, and one of the first casualties is long-term research and development projects. On the other hand, sometimes inflationary pressures serve as a catalyst for productive cost reductions such as downsizing. Also, the auto industry has been making record profits, and GM for one rarely borrows money because it has been able to generate money internally. Nevertheless, as the influence of inflation on investment decisions makes evident, the Government's commitment to controlling inflation doesn't merely help the consumer's pocketbook directly in the short term. Inflation can have very long-term, secondary effects on the consumer that may be even more damaging. The regulatory program pushes the industry to treat societal goals seriously and not cut them back as the first casualty of a tight market.

Of course, safety, conservation, health, and environmental regulatory programs also contribute substantially to the control of inflation. Increased hospital costs can be offset by decreased numbers of maimed people and by improvements in the general health of the public. Decreased vehicle damageability can reduce automobile insurance costs just as improved vehicle safety can. And, of course, our fuel economy program will have a substantial effect

not only on the cost of operating an automobile; it will help to control our enormous appetite for high-cost, inflation-producing petroleum imports.

We are looking forward with great anticipation to the vehicles of the mid-1980's -- the socially responsible automobile and its companion trucks, vans, and buses. We expect these vehicles to contribute not only to our economic and environmental well-being as individuals, but also to the country's well-being.

In conclusion, let me reiterate, it is important to distinguish between innovation that is needed to fulfill the consumer health and safety rights and the kind of innovation that merely refines the engineering of the high compression engine.

Second, innovation becomes more necessary as the passing years expand the gap between the growth of problems and the technology available to solve these problems. Alfred North Whitehead put it with characteristic wisdom: "Duty," he said, "arises from the power to alter the course of events." This is not 1940 when Los Angeles was just beginning to experience photochemical smog from the automobile's exhausts; this is not 1950 when auto crash-casualties were viewed as solely the fault of the "nut behind the wheel"; this is not 1960 when a glutted oil industry was holding down domestic production through State production controls; this is not 1970 when an Administration looked at the auto crisis burgeoning on many consumer and environmental fronts with cool indifference if not outright hostility. This is 1978 -- a time of computers and space vehicles, communications satellites and early solar energy -- and of motor vehicles that still wouldn't surprise your great grandfather.

As several auto executives have been saying in recent speeches, the times are changing, consumer expectations are rising higher and going deeper. This is no safety pin industry with an essentially mature technology. Motor vehicles are an unfinished technology that desperately needs what industry engineering creativity can give it -- heavy infusions of humane engineering progress that provide life saving and economic benefits for consumers.

Footnotes

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16. A number of innovations have resulted, at least in part, from regulation of the automobile. These include:

- Passive occupant restraint systems. In the late 1960's, Ford (in combination with the Eaton Corp.) and GM began air bag development programs. These programs were designed to provide a better alternative to the active safety belt. In the early 1970's, in response to rulemaking to require passive restraints, Volkswagen developed a less expensive and simpler passive belt system, which they have offered on the Rabbit model since 1975.

- The combined pressures of environmental and fuel economy requirements led to the development of several innovative engine technologies: the catalytic exhaust converter, stratified charge engines, and electronic engine controls, to name three of the more important recent ones.

- Requirements for bumpers that protect automobiles in collisions at up to 5 miles per hour (10 miles-per-hour car-to-car impacts) have led to a number of innovations in bumper technology such as improved hydraulic shock absorbers and soft-faced plastic systems that have the additional advantage of providing improved pedestrian impact protection.

- Innovations in "slippery" lubricants have resulted from the need to improve fuel economy, mostly to meet Federal fuel economy standards.

- The fuel economy program is resulting in innovations in the configuration of vehicles built in North America (such as front wheel drive) as well as in the use of new materials (such as plastics, aluminum, and high strength-low alloy steels).

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APPENDIX A

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Technological Change and the Automobile Industry

The Changing Incentives for Research, Development and Innovation in the U.S. Automobile Industry

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Technological Change and the Automobile Industry

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APPENDIX B

INITIAL PROPOSAL

A Proposed Workshop

on

Managing Technology in the Automobile Industry:

The New Energy Environment

Proposal:

It is proposed that a project be established to conduct an 18-month workshop on: Managing Technology in the Automobile Industry: The New Energy Environment. It is assumed that the workshop will be conducted with support and funding from the U.S. Department of Transportation and would begin in January 1977 and continue until June 1978.

Purpose:

The purpose of the workshop is to develop a better understanding or problems in managing technological change in the automobile industry. The development and adoption of new technology within the automobile industry offers a promising step toward important national energy objectives as well as other goals concerning automobile safety, environmental effects, and the vitality of the industry in the U.S. economy. The workshop is to provide a forum where the perspective of those in government, industry and scholars in the field can be brought to bear on common issues. The focus is on factors that influence the effectiveness of technological change within the industry and substantive issues at stake in related management problems.

Output from the Project

Over the course of the project several different types of results will be produced. The most tangible of these will be the stated research finding, the written paper and published proceedings which the project will develop. The most important product, however, is intended to be the channels of inquiry and communications that are opened and the influence which will be indirectly exerted over the direction of future analysis at other organizations.

In specific terms, the following products or outcomes are expected:

- Create a forum in which major issues concerning the management of technological change in the U.S. automobile industry can be examined and studied in balanced perspective.

- Develop an informed statement of pivotal issues in respect to the effective management of technological change within the U.S. automobile industry.

- The issues are to be pivotal in the sense that they make a difference in the choice of appropriate management action or policy to achieve needed technological change within the automobile industry.

- Plan and conduct a workshop to focus and clarify the identified issues. The workshop will examine existing research and also promote new findings by inviting papers, presentationa and the direct participations by industry experts, managers, policy makers and scholars in the field.

By its nature, the workshop is intended to have an influence in shaping and focusing the research directions of others, beyond the limited number of direct participants.

- Conduct and report direct exploratory research for selected issues where current research is not in progress. The purpose of this work is to insure coverage of important issues and at the same time involve workshop principles themselves in on-going studies of the industry.

- Conduct a major seminar at the conclusion of the workshop, emphasizing future action and mechanisms for cooperation between industry, government and for future study and problem solving. Results of the seminar are to be published.

<u>Conduct of Project and Schedule</u>

Within the project there are three major tasks:

1. A continuing research workshop involving participants from the immediate Boston area (including Harvard, MIT, and the U.S. (DOT) Transportation Systems Center) and invited participants from outside the area.

2. A major seminar at the conclusion of the workshop to report and test results and to establish the prospects for future action.

3. A workshop support and research function that will help to survey prior and on-going research, and carry out selected exploratory studies to define issues.

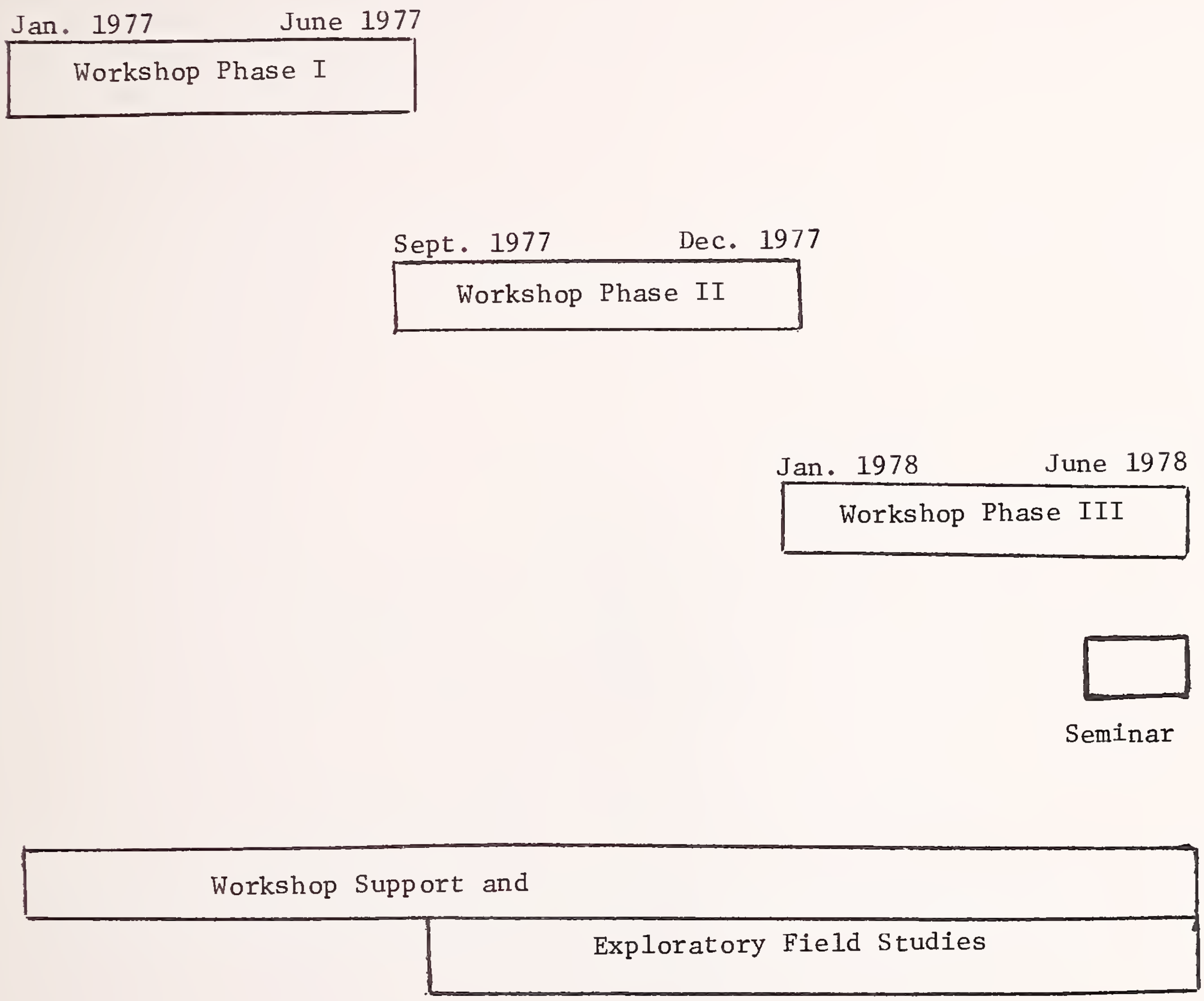
The workshop will be conducted throughout the project but it will be organized in three phases with different objectives.

Phase I Explore and Clarify Issues for Inquiry - Jan. 1977 - June 1977

Phase II Define Alternative Substantive Positions on Issues - Sept. 1977 - Dec. 1977

Phase III Evaluate Alternative Position on Issues - Jan. 1978 - May 1978

The workshop, seminar and workshop support functions would be carried out according to the following schedule:



APPENDIX C

EXAMPLES OF SUPPORT MATERIALS

FOR

WORKSHOP SESSIONS

ISSUES SUGGESTED BY PARTICIPANTS

TO THE

APRIL 6th MEETING ON

TECHNOLOGICAL CHANGE IN THE U.S. AUTOMOBILE INDUSTRY

"THE U.S. AUTOMOBILE SUPPLY INDUSTRY"

The issues submitted to date by participants for discussion in the forthcoming workshop are abstracted in this summary. To maintain anonymity, the origin of the issue is only indicated by broad categories:

G - Government Participant
I - Industry Participant
O - Other Participant

Many of the issues represent questions which participants from one segment of the industry wish to discuss with others. These are generally a request for assistance in clarifying current problems or trends in the industry. These queries are included first in Section I. Within this section the issues are separated by the industry sector to which the question applies. The second, smaller group, under Section II generally concerns a possible solution or a question about a solution.

Although we cannot cover all the issues that have been submitted, many excellent questions have been raised that warrant serious consideration. We will have an opportunity to discuss the agenda Thursday night at dinner, and to adjust it as appropriate.

I

IDENTIFYING THE PROBLEMS IN DIFFERENT SECTORS

A. Component Manufacturers

1. The current effects of regulatory changes on firms that produce components.

   1 (G) Federal Regulation in the areas of safety, emissions and fuel economy as well as market forces have caused changes of unprecedented magnitude to be made in automotive vehicles over the 1965-1985 period. Vehicles and their component parts must now perform in accordance with specifications more stringent than before and are tested for compliance. What impacts have fallen on the supply industry with respect to the following as a result of these changes?

   Engineering, Development, Test - Costs, Resource Requirements
   Manufacturing Costs
   Lead Time
   Quality Control Requirements
   Product Liability/Recall
   Insurance Availability

   2 (I) Government regulations which require the OEM's to warrant vehicle performance tend to prevent the supplier industry from participating in the sale of repair parts.

   For example, the Clean Air Act requires a five year/50,000 mile warranty on the performance of the emission system, and the OEM's are required to repair or replace emission control systems, at their expense, which are found to be defective during the warranty period.

   The performance capability of emission-related parts installed and the quality of workmanship used in the normal service and maintenance of a vehicle affect the vehicle's emission level. The OEM's are, therefore, motivated to specify that only OE parts and service be used to maintain their vehicles during the warranty period. This prevents the independent parts manufacturers and independent service shops from competing for the emission-related service business and places them at a serious disadvantage in competing with the OEM's for the non-emission related service business during a major portion of a vehicle's normal service life.

   A significant loss of replacement market sales by the supplier industry will discourage capital investments and, in the long term, diminish the supplier industry's ability to design, develop, and supply parts and services to both the OEM's and the vehicle owners.

The public will be inconvenienced because new car dealer service shops lack the capacity and the ability to supply the around-the-clock, seven-days-a-week service that has traditionally been supplied by the replacement market industry. The public would also lose the advantage derived from the formidable competition in the replacement market industry if the supply industry is incapacitated or is prevented from competing with the OEM's for service business.

3 (I) The time table for implementing government regulation is too compressed. There is insufficient lead time to perfect product designs and the accompanying manufacturing methods. As a consequence, a more unreliable product is being produced today. This causes an unnecessarily high recall rate, and of more importance, dissatisfied customers. In the market, it gives foreign producers, who are already tooled-up for small fuel efficient cars, a decided edge.

4 (I) Standards set by NHTSA are reducing innovation by:

A. Not providing enough degrees of freedom.

B. By forcing resource concentration to focus on solving short-range problems.

C. By ignoring the new problems introduced by secondary factors, i.e.,

(1) Effect on suppliers' business.

(2) Effect on non-gasoline energy usage.

(3) Effect on ability of consumer to pay.

(4) Effect on import of competitive vehicles.

5 (I) When regulations must be rescinded due to imprudent actions by regulatory agencies, how can vehicle builders and more particularly, proprietary part suppliers, who are one step removed from the planning process, be reimbursed for unrecovered R & D and manufacturing tooling costs? Indifference or lack of responsibility on the parts of the regulators leads to a reluctance on the part of suppliers to participate in programs requiring new technology.

6 (I) Traditionally, a buyer with considerable leverage in the market dictates the terms and conditions of sale. Accordingly, the OEM's have dictated such terms and conditions to their suppliers. This practice was tolerable prior to government regulations, which impose recall obligations, and prior to the sharp increase in product liability suits. Under present circumstances, it has the potential of destroying a relatively small supplier company.

2. Projecting the implications of current trends for the industry and the consumer.

7 (I) Proposed standards for trucks--The National Highway Traffic Safety Administrator's proposed new regulation would require a much greater improvement for trucks than for passenger cars. In general, truck producers rely heavily on supplier firms to develop and produce advanced components that will be needed to meet fuel economy standards to a greater extent than is the case for most passenger cars. It also is easier to improve fuel economy on a car than a truck. This regulation if adopted could have a very damaging effect on the segment of the industry that serves the market with trucks.

3. Specific problems.

8 (I) The National Traffic and Motor Vehicle Safety Act requires the OEM's to recall and repair vehicles which are found to contain safety-related defects. The OEM's have been able to meet this obligation through the use of their dealer organizations who maintain lists of names of new and used car buyers and who have the facilities and capabilities to perform the necessary repair work.

The 1974 amendments to the Act extend the recall-repair obligation to the independent replacement parts manufacturers. However, there is no conceivable way that an independent parts supplier can carry out an effective recall campaign--particularly on a part he has manufactured for a number of years and which has been widely distributed throughout the U.S. The lack of anything resembling a dealer organization and the complex distribution system that prevails in the replacement parts industry makes an effective recall campaign virtually impossible.

B. Basic Material Producers

1. Particular problems or opportunities that material and basic parts producers face under current conditions of change?

9 (G) With new automotive designs to meet fuel economy regulation and increased competition in the market for small fuel efficient cars, the major car manufacturer have in some cases turned to foreign suppliers for high performance materials. Why have these requirements not been sourced from U.S. producers? Or alternatively stated, why have U.S. material producers not been successful in competing for this business? What are the obstacles to the development of advanced materials by traditional U.S. automotive suppliers? Why are foreign firms better?

10 (G) Do firms in the supply industry expect to find short-run shortages of any inputs--labor, capital, or materials--in their efforts to enable the auto companies to meet the EPCE standards? If so, would a one-year delay in the standards make an appreciable difference?

11 (I) With the automobile companies facing mandatory mile-per-gallon efficiencies by 1985, it appears that their resolution to this edict will come through smaller cars and massive weight reduction programs. It seems that in achieving weight reduction there will be a major dislocation in raw material markets, wherein aluminum and plastics shall be substituted for steel. What impact will this dislocation have on our total economy? In fact, can such a dislocation take place, suggesting that there is insufficient capacities of the lighter materials to actually replace steel? Finally, when equating energy units saved by the automobile industry to those units necessary to produce the lighter materials such as aluminum, is there in fact an overall reduction in energy consumption, or are we deluding ourselves?

As raw material changes are made, concern is mounting over the cost effectiveness of material substitutions to achieve weight reduction. These additional costs undoubtedly will have to be passed through to the consumer. What impact will these additional costs have on the automotive marketplace and the ability to sell their product?

Is the extreme weight reduction program that is currently being pursued by the car companies absolutely essential, or is there technological know-how which will come in power plant efficiencies that will minimize a wholesale raw material change?

C. Machine Tool and Capital Goods Industry

12 (G) Will the capacity of the machine tool suppliers seriously limit the ability of the vehicle and component manufacturers to accomplish the product changes required over the next 5-10 years?

D. Major Automobile Companies

1. How are the traditional relationships between major automobile firms changing?

13 (G) Does the auto manufacturer or the supplier provide for the capital investment for product change? How has capital been provided historically? Has this relationship changed in the last ten years and what is the prognosis for the next ten years?

14 (G) Who is bearing the primary engineering and product development burden on manpower and resources for the product changes being introduced in the auto industry? Is this changing? Is the auto supply industry in a position to provide engineering to help out the weaker manufacturers in making the necessary product changes? How can we assess when the limit of available resources has been reached?

15 (G) There are indications that the number of supply firms who are willing and able to meet future requirement may be thinning out, so to speak. At the same time the major automobile producers face capital shortages as they try to meet future requirements, so that they do not have the opportunity they once did to integrate into the production of many components.

As these conditions develop it might be expected that the U.S. automobile producers will face a serious challenge to their commitment
there any indication that traditional supply relationships are already breaking down? What are the projections for the future?

16 (G) What major long-run impacts on your industries do you foresee from the EPCA standards? If passed, what additional impacts do you expect from the gas guzzler tax?

17 (I) Overall we are interested in learning if the auto industry looks for more/less or about the same level of support from suppliers in the future.

In checking what is happening in the plastics area, we note that independent suppliers used to furnish approximately 60% of the parts consumed by the industry. However, forecasts project that this will be reduced eventually to probably 40%. This leads us to question whether this trend is expected to be repeated in other areas.

E. Government

18 (I) As you know, the government regulations for fleet average mileage and emission standards have been firmly established through 1985. These requirements have resulted in a fairly well known evolution in passenger car design and passenger car propulsion unit configurations. The various OE manufacturers and components suppliers are basing their long-range research programs and capital investment programs on these fairly well known facts. My question would be whether or not the participants, especially those close to the government, feel that there will be major changes in fuel economy and emission standards after 1985 that would cause a continuing evolutionary process in the automotive industry. Conversely, do the participants feel that we would then enter a fairly stable period of technological requirements?

19 (I) Is the advesary position between DOT and auto industry necessary and desirable? Wouldn't a cooperative attitude accomplish more and more rapidly?

What was and is Congress' intent with regard to functions and results expected from passage of original legislation? Is the DOT getting too big and too complex to carry out Congress' mandate effectively and efficiently -- especially NHTSA?

20 (I) A problem exists within the Congress in failing to recognize the suppliers' role when writing enabling legislation. While some agencies are learning to consider suppliers to a degree, basic decisions are still made on what the regulators believe the vehicle manufacturers can provide. This also discourages suppliers selection of R & D projects and expenditures.

21 (I) Also, "across the board" type regulation for full production requires huge investments at specific dates. This can upset the whole OEM - supply industry in that the OEM may now find it advantageous or necessary to go "captive." A case in point is Ford's decision to establish a massive plastic operation to comply with weight reductions dictated by the Fuel Economy Program. This makes it difficult for suppliers to participate, and in some cases may actually preclude specific suppliers from continuing in the market. This in turn affects R & D expenditures and selection of programs at the suppliers level.

II

TOWARD A SOLUTION

A. Some Industry Actions

1. The prospect for Long Term Contractual relationships between automobile firms and suppliers.

22 (I) Under conditions of rapid technological change, a close working relationship between the automobile firms and suppliers is desirable. A long term relationship might reduce the risk a supplier faces in making the investments in R & D marketing, tooling and implementation that are needed for successful innovation. For the automobile firm it would provide access to new technologies, as well as management and engineering skill. Would a long term contractual arrangement be an appropriate way to structure such a relationship? What arrangements would be needed to assure the automobile producer of equitably priced components under conditions of inflation and recession? Similarly for the supplier, what arrangements would be needed to assure equitable participation in the fruits of any innovative contribution?

2. Introducing High Technology -- The Technology Transfer Problem.

23 (G) Many U.S. automotive supply firms have companion business in the so called "high technology" fields. It is commonly thought that such firms are in an ideal position to transfer advanced concepts or technologies from such fields into automotive application. There seem to be few examples where such transfers have actually been successfully made or if they have been, little recognition has resulted. What does the industry's experience with this problem suggest? Under what conditions have new technologies been drawn in to practical mass production applications? What can be done to improve management in this area?

3. Communicating Needs to Supplier

24 (I) The auto industry does not appear to have a good vehicle (namely, department, group or structure) to communicate their long range needs, i.e. equipment or processing innovations.

There are a number of suppliers who have technical competence which, if they were aware of the problems confronting the industry, could be directing their talents to solving same. What improvements in communication can the industry make to better utilize this untapped resource?

B. Government Action

1. Supply Industry Involvement in Government's Deliberations

25 (I) Better communications between the regulators, and the industry (including suppliers) and the ultimate user must be emphasized to show the cost/benefit or the cost effectiveness of the regulation and how the regulation will be beneficial to the industry and/or user.

2. A New Congressional Approach to the Review of Regulation

26 (I) Congress must address the regulatory process problem as a whole, and recommend changes in the Administrative Procedures Act. Perhaps a select sub-committee of the Congress to review the regulatory process for the Automotive Industry would provide the necessary data to change basic laws that would allow for consistent regulations. The basic laws must be looked at and modified; otherwise the regulators won't change.

3. Uncertainty Reduction Through Pilot Programs

27 (I) Regulations should consider a "Pilot Program" first for verification of the feasibility before a Full Production Program is mandated. Perhaps the "121" program would have been better handled this way.

4. The Need for Federal R & D Support

28 (I) The need for Federal support for R & D in many industries, innovation in components and ultimately materials, is seen as a pre-requisite to major innovation in final products. In other words, significant innovation is driven by progress in component development rather than the reverse case. This would seem to have been the situation in aircraft and jet engines and in semi conductors. Is this same relationship evident in the automobile industry?

Is adequate R & D being carried out in the material and component areas? What are the obstacles to innovation in this area? Is there government support for R & D in these areas? Would more Federal R & D support be appropriate?

AGENDA

Technological Change and the Automobile Industry

Supply Industry Implications

April 6th (and prior evening)

April 5th (Wednesday evening)

- Cocktails and Dinner 7:30 (8:00 PM Dinner)
- Introduction and Agenda Discussion

April 6th Kresge Hall (Ground Floor)

9:00 AM I. INTRODUCTION

The Supply Industry in the U.S. and Europe: Some Comparative Comments.

Klaus Milztrey, Volkswagen A.G.

9:30 AM II. WHERE WE STAND:

Problems--Opportunities as Viewed from Different Sectors

Quinn Mills, Chairperson/Moderator

Component Suppliers

- Implications of Regulations for Suppliers Competitive Positions and Strategies
- Effects of Regulation and Changing Industry Conditions on the Supply Industry's Performance and Capabilities
- Particular Regulatory Problems
- Product Liability Implications

Basic Material Suppliers

- International Trade Implications in Materials
- Implications of Regulatory Induced Change for the Industry

Machine Tool and Capital Goods Industry

- Implications of Regulatory Induced Change for the Industry

10:30 AM Coffee

Automobile Manufacturers

The Changing Role of Suppliers in the Industry

The Implications of Recent Changes for the Auto Manufacturers

Threats and Opportunities in Auto Company and Supplier Relationships

Government

Priorities and Prospects for New Regulations

The Changing Industry Government Relationship

Supplier's Inputs in Assessing Regulation Effects

11:45 AM	Lunch	Faculty Club (Kresge Hall)

12:45 PM III. OPPORTUNITIES FOR PROGRESS

Toward a Solution on Some Specific Problems

Quinn Mills, Chairperson/Moderator

- The Possibility of New Long Term Automobile Company--Supplier Relationships
- More Effective Technology Transfer

1:30 PM Coffee

- Gaining Supply Industry Involvement in Government Deliberations
- Congressional Involvement in Regulatory Review
- Propsects for Using Pilot Programs to Reduce Uncertainty

3:00 PM A Summary of Issues and Action Possibilities

William J. Abernathy and Douglas Ginsburg

3:20 PM Formal Session Ends

Group Informal Discussions (continued)

4:30 PM	Refreshments	Oriental Room (Kresge Hall)

APPENDIX D

STATUS OF THE AUTOMOTIVE SUPPLY INDUSTRY:
A REVIEW OF INDUSTRY TRENDS FROM THE TRADE LITERATURE

EDWARD C. DEMPSEY
HARVARD BUSINESS SCHOOL

JANUARY 23, 1978

INTRODUCTION

PROBLEMS FACING THE AUTO SUPPLIERS

A. Uncertainty in the Auto Market

B. Squeeze on Profits

C. Emphasis on Primary Materials and Electronics Technology

D. Ambiguity of Federal Regulations

E. Influx of Foreign Auto Suppliers

RESPONSE OF AUTO SUPPLIERS TO THESE PROBLEMS

A. Marketing Strategy

B. Capital Investment Decisions

C. Management Organization

D. Research and Development Strategy

INCREASING THE AUTO SUPPLIER'S CONTRIBUTION TO TECHNOLOGICAL INNOVATION IN THE AUTO INDUSTRY

A. What Can the Auto Suppliers Do?

B. What Can the Auto Makers Do?

C. What Can the Federal Government Do?

REFERENCES

INTRODUCTION

Government regulation and the energy crisis have thrust the auto makers and suppliers into a period of rapid innovation. The scope of this technological change is unprecedented in the post World War II era. To meet the changing demands of consumers and regulatory agencies, the auto companies are having to cope with enormous tooling expenses and the constant pressure to minimize costs through long production runs.

Federal mandates on exhaust emissions, fuel economy, and safety have forced change on the auto makers at a time when concern is mounting over a slowing in the pace of technological innovation in the U.S.

The burden of these government mandates has been enormous. General Motor's research and development expenditures have doubled in the last decade and currently exceed $1 billion (1). Massive capital expenditures, estimated at $45 billion through 1985, are being made by the auto industry even though long-term growth prospects have dimmed considerably (2).

The cost and risk of revamping whole product lines has had a dramatic impact on the auto maker's relationship with the supply companies. GM, Ford, Chrysler, and AMC are counting on their suppliers to come up with innovations and new ideas. In the past, "auto makers customarily defined the technologies they wanted, and then presented requests for the appropriate hardware" (3). But now the pressure on research programs at GM and, even more acutely, at Ford, Chrysler, and AMC is having a disorienting effect on product planning. Lead times for product development are shrinking. This time pressure is narrowing the "free thinking" of engineers, increasing the cost of research, and making inordinate demands on production. Clearly, the auto companies need help.

The challenge being passed along to the auto suppliers is not just realigning their relationship with the auto makers. The increasing volatility in the auto market is causing an upheaval in the supplier end of the industry.

The auto makers have a great deal at stake in maintaining the integrity of their traditional relationship with the suppliers, and should be concerned about recent trends in this segment of the business.

In the past, outside sourcing for materials, parts, and capital goods afforded the auto companies great flexibility in planning. Working together with the supply companies expanded their effective research and development capability. Suppliers even helped to defray the cost of prototype work, just to get a shot at the original equipment market. For each component the auto makers could either rely on their own in-house production capability or they could let suppliers compete for the business. Through multiple sourcing, aggressive supplier bidding, direct competition with suppliers, and selective backward integration, the auto companies were able to maximize their profit margins.

With their in-house development and production capacity becoming increasingly overextended, the 'Big 4' are finding their leverage over suppliers eroding. Flexibility in product planning is waning for the auto companies, as they become more dependent on supplier technology and more embroiled in government regulations.

PROBLEMS FACING THE AUTO SUPPLIERS

The changing needs of the auto makers leave traditional suppliers in a vulnerable position as well. While the auto companies are more receptive than ever to their ideas, the suppliers are also threatened by the rapidly evolving technology.

As Floyd C. Melby, General Manager of the Engineered-Products Division at Goodyear Tire & Rubber Company, commented to Fortune Magazine, "many of us are leaving the comfortable role of supplier and taking on the role of innovator, which is a little more precarious. We've always been a good consultant to Detroit, but now, to protect ourselves, we need to innovate as well" (3).

The situation is precarious not just for Goodyear but for most of its domestic competitors. The problems confronting these companies are similar to those plaguing many other firms in the supply end of the auto industry. The tire makers are being urged by Detroit to develop better mileage tires, and the large companies, Goodyear, Firestone, B.F. Goodrich, Uniroyal, and General Tire, are responding. While they develop new ways to cut rolling resistance, tire engineers are also looking for a way to eliminate the need for a spare tire (4,5). This expensive development work comes at an otherwise gloomy time for the tire industry. As longer-lasting radial tires are increasingly included as original equipment, replacement sales will be severely reduced. Smaller cars, decreased driving due to rising fuel prices, the push to eliminate the spare tire, and concern that auto makers will increase purchases of less expensive glass radials all point to lower profitability and growth potential (6,7,8,). NHTSA is trying to introduce a controversial tire grade labelling program, and NIOSH is concerned that carbon black, a compound used to strengthen rubber, may be a cancer-causing agent (6).

The industry is further hampered by a costly wage settlement with the United Rubber Workers— pay hikes that will not be offset by boosts in productivity (8). As predictions of a "shake-out among smaller tire firms" abound, Michelin, the world's largest radial tire producer, is stepping up its penetration of the North American market (7). While U.S. tiremakers have substantially moderated their 40,000 mile warranties, the French firm remains committed to its own (6). Michelin has every right to be bullish about their product; many industry experts consider their radials to be the best on the market. Meanwhile, the foreign tire maker is building a new U.S. corporate headquarters in New York from which the company will oversee a $600 million capital investment program in the southern part of the U.S. (9).

This example highlights the incentives for a traditional supplier to abandon the automotive OEM - 1) uncertainty about whether the auto makers can meet the jungle of government standards and still offer the customer value, performance, and luxury; 2) the profit squeeze caused by rising labor and materials costs, automaker resistance to cost increases, high research and development costs, and the impossibility of simultaneously maintaining high productivity and aggressive new product introduction; 3) emphasis on electronics and primary materials technology is increasing competition as large technically-oriented and diversified firms enter the auto industry; 4) the unpredictable enactment and ambiguous nature of many federal regulations; 5) the influx of large foreign suppliers to meet Detroit's growing need for European technology in its downsizing programs and to supply Volkswagon's new U.S. manufacturing operations.

A. Uncertainty in the Auto Market

The cyclic nature of the auto industry has been augmented by the uncertainty of 1978 auto sales forecasts. Long range planning is increasingly difficult for the auto supply companies, and new profit opportunities in the automotive OEM are risky. While Group Vice-President of Budd Company, James H. McNeal told Business Week that "from the supplier's standpoint, if his customer doesn't know how the market is going to sort out, then its hard for us to know" (10).

GM's new downsized intermediates are smaller, more costly, and similar in design to last year's models. According to The New York Times and Business Week, they have been poorly received by the public so far, as top of the line luxury cars continue to move strongly (11, 12). New domestic subcompacts are selling well, but only when priced below cost and apparently at the expense of other domestic models (2, 11, 12). The growing volatility of the auto market is being compounded by the consumer's dissatisfaction with the 1978 models, competition from imports, smaller profit margins, and domestic market saturation. And some suppliers are being hurt by this instability.

A. O. Smith Co., a leading supplier of auto frames, has traditionally enjoyed a close symbiotic relationship with GM. The company's profitability has been hurt over the last few years by the trend toward smaller cars made without the frames (10). Since full-sized cars will comprise a considerably smaller proportion of the overall industry mix, the demand for A.O. Smith's auto frames will continue to drop.

B. Squeeze on Profits

The auto suppliers are also fighting a profit squeeze. Company earnings are eroding as labor and primary materials costs continue to climb upward. The steel and tire industry are now feeling the crunch of costly wage settlements (8). To improve their profitability, the steel and tire producers are boosting their prices. Yet, supply companies have always had trouble passing along increased costs to the auto companies (13). While GM, Ford, Chrysler, and AMC have absorbed the price hike in steel, "the tire industry has been having difficulty making recent price hikes stick, with discounting rolling increases back by as much as one-third" (8).

In past years the auto companies relied heavily on luxury cars, options, and trim for profits (2). Now they are having to rework their pricing strategy. Even if thev successfully compete for a major share of the small car market, profits on these models will be slim. Compliance with federal regulations is pushing up the price of new cars, which may cause consumers to buy less expensive and less profitable sub-compacts or to simply postpone car purchases altogether. Consumer pressure on the major auto companies to hold down the price of new autos will make them even more reluctant to absorb cost increases from auto suppliers.

When profit margins are jeopardized, market leadership becomes all the more critical. To protect their automotive OE markets and establish themselves as leaders in growth areas, the auto suppliers must channel much of their earnings

into product development programs and capital expansion.

The auto makers are looking to the supply industry to provide less expensive and more durable materials and parts. At the same time, the supply companies are searching for ways to offset their higher operating costs through increases in productivity. The extreme price-competition of the supply market is creating a greater emphasis on economies of scale and manufacturing technology. These pressures are conflicting and reflect "the productivity dilemma" many suppliers find themselves in. According to one industry expert, "to achieve gains in productivity, there must be attendent losses in the capability for radical innovation" (14)

This situation is not likely to improve in the near future. The trend toward smaller cars is reducing both the number and size of parts made by the auto suppliers. Industry Week claims that the gloomy outlook for profitability has caused Federal-Mogul to pull out of some automotive OE markets (13). The company is also "in the process of discontinuing distribution of purchased valves, valve components, water pumps, cam shafts, timing components, and remanufactured oil pumps in the domestic replacement market" (15). On the other hand, Eaton is trying to offset unit volume losses in their valve business by developing a more complex version of the same product capable of improving smaller engine performance (16).

C. Emphasis on Primary Materials and Electronics Technology

Concerned about how U.S. car buyers are responding to the more costly downsized autos, the auto companies are trying to retain luxury and performance in their product. For engineers, "the only alternative is to substitute parts and components" and develop "a more efficient running engine and lighter cars," according to Arthur Davis of Prescott Ball & Tucker (17).

Primary materials and electronics are the areas being counted on to meet the challenge — areas where the auto makers and many suppliers have traditionally relied on the technical competence of other companies. As a result, high technology firms with superior technical capability in electronics and primary materials are

searching the automotive OE market for opportunities. They are attracted by the possibility of volume sales and are diversified enough to absorb the high R & D costs needed to penetrate the market and the risks inherent in a cyclical industry.

The steel and zinc die casting suppliers are having a hard time fighting off the waves of new automotive applications for ceramics, plastics, aluminum, and magnesium. The domestic steel industry has paid dearly for ignoring the changing needs of the auto companies. After failing to concentrate on new product development for many years, the steel companies are battling back with high-strength steel alloys (18-22). Though still too costly for widespread use, the development of Zincrometal by Diamond Shamrock has helped offset one of the main drawbacks of carbon or HSLA steel - corrosion resistance. The Zinc Institute, Inc. and the International Lead Zinc Research Organization were mandated by the zinc industry to concentrate on weight saving/energy saving problems in the auto industry in an attempt to win back auto parts applications for zinc (23). They responded with the development of thinwall zinc die casting technology. Zinc sales have rebounded from their longterm slump, as automotive applications for thinwall zinc die castings have risen dramatically.

Meanwhile, Union Carbide, Celanese, and Hercules are advancing their graphite fiber technology in hopes of finding large-scale uses for the aerospace material in the auto industry (3,22,24). General Electric's Plastics Division has established an automotive group in Detroit to take advantage of the marketing potential for their Noryl resin (thermoplastic) technology (25,26). And Corning Glass Works, developer of the CELCOR ceramic substrate for use in the industry's catalytic converter, is now introducing an aluminous keatite ceramic for rotary regenerator cores in automotive and industrial turbine engines (27).

Traditional automotive parts and subsystem manufacturers are having to

infuse electronics and primary materials technology into their product planning or risk being supplanted in many OE markets. With electronic fuel injection systems threatening to replace carburetors in the next generation of gasoline powered automobiles, Carter Carburetor Division of ACF Industries, Inc., has recently developed a digital electronic control unit and air metering electro-mechanical device to automatically regulate the air/fuel ratio in its standard carburetor (28,29). Elsewhere, Texas Instruments, Inc. and Intel Corp., pioneers in semiconductor and microcomputer development, were recently selected by Ford's Electrical and Electronics Division to supply advanced large scale integrated circuits for electronic engine modules (used to control engine spark timing, exhaust gas recirculation, fuel metering, and other functions).

These R&D-oriented firms are not just supplying the auto makers and traditional auto supply companies with new ideas and materials. They are also entering into end-product manufacturing to maximize their opportunities in the auto market. For example, "Reynolds Metals has never shied away from going into the manufacture of end products, even if it meant competing directly with its customers to demonstrate a new use for aluminum" (30). While Kelsey-Hayes was developing a fabricated aluminum wheel in cooperation with Reynolds, Alcoa responded to GM's urging with a comparable product of its own (31).

The massive capital expenditures being made by the auto companies and their suppliers are providing a great deal of business for production equipment manufacturers. Advanced component design, downsizing of parts, and frequent materials substitution are making waves in this segment of the auto supply industry as well.

All of the lightweight substitutes being considered for automotive applications are more expensive than steel, and each of the materials has its own production drawbacks. Aluminum is difficult to weld and form, while high-strength steel alloys (HSLA) lack the machinability of carbon steel (3,32). Plastics

applications are being held up by "relatively long cycle times for formation into parts," frequent surface imperfections requiring hand finishing, and poor coatability (3,33). Consequently, intense research and development efforts are being waged by the major primary materials suppliers to reduce production costs and overcome the technical problems arising from materials substitutions. Productivity losses resulting from the hurried pace of new product introduction has to be minimized, if the sticker price of tomorrow's auto is to stay in sight.

To maximize the profit potential of their newly developed primary materials and parts, many of the high technology firms are playing an active role in the production equipment industry. Plastic molding technology is advancing quickly due in part to the aggressive efforts of Owens-Corning Fiberglas Corp., the world's largest producer of fibrous glass products (21,34). Improved high-throughput molding techniques have enabled their engineers to develop an automobile door made of Fiberglas-reinforced-plastic sheet molding compound (3). In an elaborate study, Owens Corning has demonstrated the cost competitiveness of their new plastic door (3). Less tooling is required with the plastic parts, and the new design consolidates major components into fewer parts. As a result, production efficiency would be improved and assembly costs reduced.

D. Ambiguity of Federal Regulations

Ambiguous federal regulations have also had an unsettling effect on the auto supply industry. Inconsistencies in the goals of regulatory agencies, the absence of cost effective studies, and prematurely imposed standards have made product planning risky and difficult. DOT originally required a seat belt interlock system be installed in all 1974 U.S. car models. Overnight this sweeping mandate created a need for 11 million seat belt interlock modules each with a variety of electronic components. The electronics industry responded effectively to the challenge, only to be stunned the following year when the

requirement was voided (35). They did not regain this lost business until the controversial motor vehicle safety standard No. 121 was adopted in 1974. The regulation called for the introduction of antilock equipment on all trucks (36). A variety of computerized braking devices were developed by OE suppliers to comply with standard No. 121 and are now the target of much criticism. Some industry spokesmen claim that the electronic anti-skid devices are unreliable, and there is fear among supply companies that the requirement may be junked. As O. Lee Henry, Vice-President and Group Executive of Bendix Corporation's heavy-vehicle systems group lamented, "it scares the hell out of me that the government may pull the plug on the market" (36). After NHTSA relaxed its stopping requirements for trucks, Rockwell found itself with a system that exceeded the required standard. As a result it was too expensive to compete with other models. According to Business Week, uncertainty over the fate of the regulation was partly responsible for their subsequent pull-out from the market (36). Last year DOT "ordered automatic crash protection systems for new cars, beginning with some 1982 models" (35). Even though Eaton has spent over $20 million developing air bags, they are opposed to the government mandate and to their cancellation of a planned 440,000-car experimental air-bag program (35,37). "If DOT had played a more restrained role in encouraging the product, we are convinced that the air bag would be commonplace on the highway" said Marshall Wright, Eaton's Vice President of Public Affairs (37). He believes that the requirement will lead to the demise of the air bag. "There will be an unacceptable number of malfunctions upon which public attention will focus. The public will lose confidence in air bags and become hostile to the mandate" (37).

E. Influx of Foreign Auto Suppliers

Domestic automotive equipment suppliers are worried about the current invasion of foreign suppliers (Michelin is not alone!). These European firms see a growing market for their expertise in designing and manufacturing small

car components, as Detroit tries to capture a major share of the U.S. small car market. Meanwhile, Volkswagon will begin manufacturing Rabbits in the U.S. this spring with hopes of regaining its leadership position among U.S. importers. Honda is setting up a motorcycle factory in this country and like the other Japanese importers, is debating whether or not to build cars here (9,38,39).

Incoming German firms expect to supply not only VW but also GM, Ford, Chrysler, and AMC with a variety of auto parts. Robert Bosch set up a plant in the U.S. three years ago for the manufacture of diesel injection devices and will be a likely supplier to VW if and when a diesel-powered Rabbit is domestically produced. Another German supplier, Keiper KG, already had a growing business with Ford and GM before setting up manufacturing facilities in the U.S. (40). Now they are planning to make seat adjustment and window cranks at a new plant in Michigan for both domestic and foreign auto makers. Last spring, a subsidiary of ITT, Alfred Teves, began production of brake equipment in this country. Though a major VW supplier in Germany, the company is concentrating its efforts on the U.S. aftermarket for European cars, including VW, Saab, Vovo, BMW, and Alfa-Romero (40). If U.S.equipment suppliers fail to provide VW with the parts it needs, the German auto company will probably pressure even more of its traditional suppliers to set up operations in the U.S.

Due tc the weakness of the dollar on international money markets, the depressed state of the U.S. stock market, and the favorable investment climate in the U.S., many foreign firms are entering U.S. markets by buying U.S. companies (9,41). In an apparent maneuver to skirt import restrictions, Japanese companies are studying the market for possible deals (41,42). Just last week Thyssen A.G., the leading steel maker in West Germany, offered to buy the Budd Co. for $275 million (41). Other U.S. auto suppliers with 'good track records' and good management may be next.

RESPONSE OF AUTO SUPPLIERS TO THESE PROBLEMS

How are the auto supply companies responding to the growing number of

problems in their industry? The uncertainty and volatility of the auto market is having an impact on their marketing strategies, their capital investment decisions, their management organization, and their research and development priorities.

A. Marketing Strategy

Diversification away from the domestic automotive OE market is a popular move among suppliers. Many are channeling their efforts into truck and specialty (on-and-off-highway construction vehicles, farming vehicles, land-moving vehicles) OEMs. Sales fluctuations in these markets are not in synchrony with those of the automotive OEM. Hence, diversification into these other segments of the auto industry ensures more stable earnings. The volumes are lower in these markets which reduces the threat of backward integration. The lower volume of non-automotive on-and-off-highways OEMs also enables vehicle buyers to specify many of the components that they want to buy. This flexibility enables a lower volume company to market a premium product with less risk of being put out of business. The suppliers also have more flexibility in pricing, and the competition is often a little less intense than in the automotive OEM. All of this translates into healthier profit margins for the suppliers.

Auto makers have had to devote most of their attention to meeting regulations in the passenger car OEM, and as a result they are much more dependent on suppliers to initiate changes in truck and specialty vehicle design. New safety and fuel economy regulations for the truck industry are looming, and the auto companies will be counting on the supply companies to help them comply. Dana Corporation has established itself as one of the industry's most profitable companies by meeting the product needs of this market. Passenger car OEM sales as a percentage of Prestolite's total sales have declined in recent years. The company has retrenched its product lines around its areas of technical expertise and is establishing a leadership position in specialty OE and auto replacement parts markets (43,44).

The passenger car and truck aftermarket is another segment of the industry that appeals to suppliers. The replacement market offers high volume sales, more freedom in pricing products, less dependence on single customers, and less drastic sales downturns. This market is clearly less risky — requiring less research and development outlays and more emphasis on marketing innovation. The aftermarket is TRW's most profitable area of business, and they intend to increase their involvement in it (45). Other companies are also looking enviably at Champion Spark Plug's success in the aftermarket. Their earnings are already impressive, and Robert A. Strachan, Champion's Chairman and President, predicts that the world spark plug market will exceed the projected 4% growth rate in the total auto aftermarket (45). Consumers are more aware of automotive maintenance due to rising gasoline prices, and car owners are holding onto their vehicles longer.

Growth into foreign auto markets is being undertaken by many auto supply firms. The serious entry of U.S. auto makers into the small car market is going to make their autos more competitive abroad. This could mean market opportunities for U.S. suppliers willing to set up or expand operations abroad. Though there is tremendous market potential in Europe, the structure of their truck OEM and aftermarket has hampered efforts to realize it. Vertical integration has been discouraged in the European auto industry, but the auto makers have held tightly to replacement parts franchises (47,48). In developing countries the governments have prevented auto makers from integrating into producing parts, consequently, suppliers like Dana, TRW, Bendix, and Eaton have come in and supported their assembly operations (49). In contrast, the European truck industry is vertically integrated, and only recently have American component manufacturers been able to supply this market. "The Eaton Corporation has made great efforts to penetrate this market with a unique strategy called 'retro-fitting'. Retro-fitting simply means replacing a unit with a substitute whose performance is equal to or greater than the original" (50). The company is hoping that

satisfied customers will force the truck makers to provide Eaton parts as optional equipment.

Diversification away from the domestic automotive OEM has led some firms out of the auto industry altogether. This strategy has has mixed results. Cummins Engine Company diversified away from the transportation industry in the early part of the decade, and a surge in diesel engine sales caught the company seriously deficient in production capacity. Their negligence cost them a sizeable portion of their market share. To restore profitability, Cummins had to rapidly divest itself of its non-engine ventures and is concentrating on making diesel engines once again (51,52). On the other hand, TRW has successfully combined its traditional auto parts business with entries into high technology markets like data communications, aerospace electronics, and most recently, point-of-sale retail terminals (45). By making use of its expertise in many R&D-oriented markets, TRW is ready to capitalize on the automobile electronics boom.

Auto supply companies are also diversifying into different segments of the automotive OEM. They are trying to anticipate auto maker needs and juggle their product lines accordingly. Forbes Magazine recently reported that Hoover Ball & Bearing Company was the most profitable auto supply company over the past five years (17). Originally, the company supplied the auto industry with metal balls, antifriction bearings, and castings. Besides expanding into several non-automotive markets, Hoover has now established itself as the largest independent producer of seating units in North America. Their dual capability in steel springs and urethane foams helped them secure a contract to supply seat frame assemblies and molded urethane foam seating units for VW's Rabbit. Hoover recently acquired two companies that produce chrome-plated injection molded plastic parts and a third company that is a leading producer of machinery for manufacturing structural foam parts (53). They have also involved themselves in the

injection molded plastics business, a future high growth segment of the auto market.

Armco Steel Corp. has improved its profitability by diversifying away from basic steel production. Its strategy has been to "make limited investments in small ventures and then grow them into substantial profitmakers" (54). As a result the firm is looking for "a small producer of plastic auto parts that may help make up for any steel sales lost because of Detroit's continuing shift away from steel toward materials that are lighter in weight" (54). The automotive glass supplier, Libby-Owens-Ford, has always been very dependent on GM's purchases. To counter reductions in sales to the largest U.S. auto maker because of its downsizing program, the company acquired Custom Trim Products, Inc., a producer of plastic self-adhering moldings for cars (17,55).

While primary materials suppliers are diversifying into auto equipment manufacturing, some component and production equipment firms are merging their operations . In a similar fashion to Hoover Ball and Bearing Company's acquisition of a manufacturer of machinery for making structural foam parts, McCord Corp. is finalizing a merger with a large production equipment manufacturer (56). Ex-Cell-O Corporation's expertise in machine tools and developmental work on structural foam molding machines will enhance the product development capability of this growing component supplier (57).

Two of the most profitable and more traditional auto suppliers, Timken and Champion Spark Plug, have achieved high stable earnings despite maintaining a very narrow product line. They have done it by finding new applications for their products - tapered roller bearings (Timken Co.) and spark plugs (Champion Spark Plug Co.) - in as many different markets as possible.

B. Capital Investment Decisions

Capital expansion programs throughout the auto supply industry reflect these new marketing strategies. They also reveal not only the commitment of

many suppliers to stay in the auto industry but also the risks of doing so. To increase production capacity, reduce manufacturing costs, and integrate new technologies into their R&D programs, Goodyear, Eaton, Borg-Warner, Rockwell, PPG Industries, Dana, and several others are spending huge sums of money. C. G. Hogan, Chairman of McCord Corporation, told WARD'S Auto World that his firm's current earnings "were being sacrificed to invest in equipment and facilities that would enhance future earnings — especially a new plant and tooling for its Davidson Rubber Division to produce reaction injection molded fascias for Davidson's new, lighter weight soft urethane automotive bumper systems" (58). Eaton Corp. will be spending $750 million over the next five years for new products and facilities, while Rockwell plans to strengthen its automotive operations with an investment of $300 million in capital improvement and expansion between 1977 and 1980 (59,60,61).

Not all suppliers are pouring money into capital expansion. The aluminum industry is just recovering from a bout with overexpansion and Alcoa's capital spending restraint is keeping aluminum expansion low and prices high (62). The company has such a large fraction of the aluminum market that it can control the price competitiveness of the lightweight material in the automotive market. Back in Detroit, aluminum automotive applications continue to rise despite auto maker concern that a major shift to the material would cause shortages - something they cannot afford (63). In an interview with Automotive Industries, P. T. Broshaham, General Operations Manager of Ford's Casting Division, emphasized that, "an assured supply of metal, at a competitive price, is essential to our product planning for weight reduction" (63).

C. Management Organization

New management concepts are needed for companies working in the highly regulated auto industry. To keep up with rapidly changing technologies, customer needs, and government regulations, a growing number of auto suppliers are

revamping their management structure. This past year Rockwell International reorganized its automotive operations into four groups — On-Highway, Off-Highway and Supply, General Components, and International — to speed up its response to market conditions and better serve its customers (64). After enduring a costly miscalculation of diesel engine demand in the early 1970s, Cummins Engine Company is now basing its marketing and new product development strategies on five-year forecasts (51). Last year Del deWindt, chairman of Eaton Corp., announced that his company's "number one strategy is to develop greater participative management"(59). General Electric Co. has just recently reshuffled their executive hierarchy and added a new layer of senior management (65). Long considered a leader in innovative management, GE is trying to "create a management structure that frees the three-man executive office from an ever-increasing internal workload and permits it to focus more attention on external matters, such as government regulation and taxation, that are expected to have an even heavier impact on the Corporation in the 1980s" (65).

D. Research and Development Strategy

In the auto supply industry, the highest R&D expenditures are coming from 1) traditional suppliers trying to regain market leadership and restore profitability; 2) smaller firms trying to maintain or establish market leadership in highly specialized components markets; and 3) diversified high technology companies trying to find new applications for their products in the auto industry.

As part of their comeback strategy Cummins Engine Company "is devoting more than 4% of its sales dollars to researching and developing prototype engines and components" (51). Bendix has been trying to improve its profit margin by earmarking almost 3.5% of its sales dollars for research and development over the past two years (66,67).

Many specialty auto suppliers are maintaining their strong market positions by channelling a considerable fraction of their revenues into R&D. Companies

having success with this strategy include Sun Electric Corp. (leader in diagnostic computer and electronic automotive test equipment), Gleason Works ("produces the largest quantity and greatest variety of machines for the manufacture of bevel and hypoid gears in the world" (68)), McCord Corp. (established itself as a major supplier of arm rests and impact crash padding and is now a leader in the development of flexible bumper systems), and Hoover Ball & Bearing Co. (leading independent producer of automotive seating).

Innovative multi-industry companies like General Electric, Corning Glass Works, Gould, and Dupont continue to place a strong emphasis on product development. Penetrating new markets with innovative products reduces competition and is the key to their profitability.

Many auto suppliers, and most other U.S. companies for that matter, have become more defensive in their approach to research and development (69). Even spokesmen for the high technology firms are second-guessing their commitment to basic research and new product development. Recently, Arthur Bueche, Vice President of Research and Development at General Electric Co., publicly expressed concern that U.S. technological innovation was slowing down (70). The chemical industry's traditional leader in R&D, Dupont, decided four years ago to "venture into fewer new markets and to stick mainly with established businesses" (71). Many firms are shying away from basic research and new product development and are instead emphasizing process innovation, improvement of existing products, and application of off-the-shelf technologies (71,72). New product development has simply become too expensive for some companies.

It is no wonder then that many auto suppliers are struggling to introduce new products for the auto makers and at the same time control the growing risks encountered in their development. Supply companies have to be prepared to spend enormous amounts of money on new product development, prototype work, and testing before an innovation gets into production. Due to changing customer

needs, some new products may never even get into production. At least for the auto suppliers, the pressure to innovate is tempered by the high costs and risks associated with research and development in the auto industry.

Pressures from consumers, government agencies, and the auto makers are making product planning extremely difficult. Supplier R&D directors must integrate many design priorities into their plans; these include emissions control, fuel economy, safety, noise reduction, serviceability, corrosion resistance, product durability, parts standardization, and reduction of the number of parts (73-77). Many of these priorities are conflicting — emissions control and fuel economy, for instance — and require product planners to make trade-offs.

The more conservative approach to R&D is manifesting itself throughout the auto supply industry. Corporate management is trying to maximize the returns and minimize the risk on each dollar spent for R&D.

Computer technology is helping automotive engineers cope with their product planning headaches. Computer-aided design (CAD) and computer-aided manufacturing (CAM) techniques are being used throughout the auto industry to minimize the risk and cost of new product development. Materials engineering, structural analysis, prototype testing, purchasing, and quality control can be done more efficiently, thus cutting down on design lead time. Timken is using CAD to find new applications for tapered roller bearings, while A.O. Smith uses computer technology to undertake finite element analysis of proposed auto frame designs (78,79). Two new software packages, Synthavision from Mathematical Applications Group, Inc. (MAGI) and PADL from the University of Rochester, could enormously reduce the time required for structural analysis (80). With the help of this technology, engineers can "now generate a three-dimensional, mathematical model of a solid, nonexistent part and display it on a video screen with all the realism of a photograph" (80).

Many auto suppliers are emphasizing process innovation in their R&D

strategies. Goodyear is trying to improve its tire manufacturing process, to allow for a reduction in the weight of its existing product line (4). Federal Mogul developed the Sinta Forge process for producing long lasting and more reliable bearings from high density powdered metal (78). The technique is now being used for production of automotive transmission parts. Another component supplier, Bailey Division of USM Corporation, has recently "developed machines and processes that perform the specialized operation of producing rubber extrusions over metal cores" (26).

To reduce the risk of product development work and to gain access to other firm's technical capability, many auto suppliers are engaging in joint development efforts. This strategy enables companies in different segments of the auto industry to complement each other's expertise. Kelsey-Hayes, a traditional leader in the wheel and brake segment of the auto supply industry, cooperated with Texas Instruments in the development of a digital anti-skid braking device and with Reynolds Metals in the development of a new fabricated aluminum wheel (31). This past year Robert Bosch agreed to buy almost 10% of Borg-Warner's outstanding stock. Since Bosch is a leader in automotive electronics and Borg-Warner has mechancial expertise in the auto industry, both companies "see an opportunity to conduct common research and to exchange information on automotive equipment and other fields" (81). In a crucial area of research for both companies, Owens-Corning Fiberglas and Cincinnati Milacron are working on the glass reinforcement of urethane elastomers using the reaction injection molding process (19). While engaging in an unsuccessful project to develop a high energy zinc chloride battery, Gould, Inc. was able to share the costs with two other partners, Gulf and Western Industries, Inc. and the Hooker Chemicals Division of Occidental Petroleum Corporation (71). Even split three ways and only 1&1/2 years into development, the aborted project cost Gould close to $1 million.

Gould and Alcoa have changed the structure of their research and development

programs to "get the risks of innovation under even tighter control" (71). Gould has set up a scientific committee of outside experts to review research proposals and has formulated "strict criteria to take some of the guesswork out of new-product introductions" (71). To keep basic research more closely tied to marketing and manufacturing, Alcoa decided in 1973 to merger its "long-independent research lab with three development divisions" (72).

The increasing competition in the auto supply industry due to aggressive specialty suppliers (one product companies) and diversified electronics and primary materials companies is causing some firms to become more specialized. James Gage, Vice President of Engineering for Prestolite Electrical Division, explained that due to competition stirred up by smaller specialty suppliers, his company has retrenched its R&D efforts and product lines around its strengths(44). In the early 1970s, Prestolite produced decorative lamps, windshield wipers, and horns along with its electrical products, as a service to the auto makers. But the Company has discontinued production of most of these items, as smaller companies now compete for industry leadership in the production of each part.

Technology transfer programs have helped some auto suppliers respond more effectively to the changing needs of the auto maker. For instance, those suppliers that expanded into the European market before today's trend toward smaller cars in the U.S. are now selling their small car technology to Detroit. Bendix, TRW, Eaton, and several other firms are all profiting from the current emphasis on European technology in this country.

Diversified giants like Union Carbide, PPG Industries, United Technologies, ITT, General Electric, Rockwell International, and TRW are finding that their involvement in the aerospace and telecommunications industry has placed them in a golden position to penetrate the automotive market with advanced primary materials and electronic products. When Rockwell's Automotive Operations developed their computerized Skid-Trol system, their engineers utilized the

Company Electronics Group's digital computer technology (82).

Auto suppliers are also transferring technology between the automotive OEM and the truck OEM. According to Iron Age, "materials, tooling, and production technology gained in development of Ford's all-welded aluminum truck cab may be a springboard for aluminum into autos" (83). The lower volume truck OEM offers product planners more flexibility than the automotive OEM. Prestolite was able to introduce, perfect, and develop its breakerless inductive ignition system in specialty OEMs, and was later called upon by auto makers to introduce its system in pasenger cars. With fuel economy standards soon to be imposed on the truck industry, innovative techniques for reducing weight and saving fuel in passenger cars will find widespread application in this market as well (84).

Rather than doing their own research and development some auto suppliers are buying technology; these companies either license it or they takeover companies that have developed it. Monroe Auto Equipment Company responded to the fuel shortage with the introduction of a new energy saving oil filter (Monroe Filter Plus[tm] oil filter). This replacement parts supplier licensed technology from Atlantic Richfield Company and Dow Chemical Company, improved on it, and finally developed a new product out of it (85). This past year, Owens Corning Fiberglas strengthened its position in the plastic sheet molding compound industry by "purchasing certain moldings resin technology from SCM Corporation's Glidden Coatings and Resins Division (55). Elsewhere, Bendix licensed certain aspects of its electronic fuel injection system to Robert Bosch who later improved on it and now market the modified version throughout Europe.

Other suppliers, like Dana and Eaton, supplement their internal development of new products with "acquisitions of companies that have substantial investments in research on products in which they are interested"(86). Dana's 1976 10K Report reveals that their management considers such takeovers to be an

attractive alternative to in-house product development. Eaton reportedly has undertaken a merger with Carborundum Co.. The huge auto parts supplier is interested in Carborundum's ceramic auto parts research and would like to have access to the proprietary ceramic fibers it has developed. According to Business Week, Carborundum Co. had apparently refused to enter into a joint development effort with Eaton, thus precipitating the takeover bid (87).

INCREASING THE AUTO SUPPLIER'S CONTRIBUTION TO TECHNOLOGICAL INNOVATION IN THE AUTO INDUSTRY

Many auto suppliers have diversified away from the passenger car OE market and are becoming more conservative in their approach to research and development. An effort needs to be made by the auto supply companies, the auto makers, and the federal government to improve the automaker-supplier relationship in such a way that these trends can be reversed.

A. What Can the Auto Suppliers Do?

The auto supply companies need to adjust their management organization and style to the changes occurring in the market place. New skills will be needed to manage in the heavily regulated auto industry. They are 1) the ability to understand and work with government, 2) the ability to understand and respond to changing industry economics, and 3) the ability to correctly perceive the consequences of government regulation (88). Auto suppliers need to foster these skills and improve their interface with other suppliers, auto companies, and government, so they can anticipate changes in the marketplace and respond to them more effectively. Reginald Jones, Chairman of General Electric Co., realized this need and restructured his company's management structure accordingly. Rather than simply complaining about the costly paperwork involved in complying with regulations, astute managers will try to influence what goes into each regulation by properly informing the appropriate regulatory agency. Further, by assessing the impact of government mandates on their own cost structure

of doing business and estimating the relative effect on each of its competitors, management can pinpoint new competitive opportunities (88).

Besides improving their business relationships with government regulatory agencies, some auto suppliers could improve their marketing and purchasing contacts with auto companies and suppliers. The integrity of these business relationships is essential for a supplier to "understand and satisfy the needs and wants of customers" (89). McCord Corporation's emphasis on effective marketing is interesting in this respect. As described in their 1976 Annual Report, "each McCord division supplying the OE market has its own marketing organization even though many of the principal customers are the same. This structure enables each division to better understand the product needs of its customers and gives the Division President direct marketing responsibility" (89). A chief marketing executive coordinates sales, new product development, pricing, and market planning within each division. He devises a five year marketing plan each year based on a ten-year industry forecast. All of this is integrated into a comprehensive strategy for the entire company aimed at profit optimizing the business mix.

B. What Can the Auto Makers Do?

The auto makers may also be able to improve their working relationship with the auto suppliers. There is an apparent need for the auto companies to do what they can to reduce the high risks and costs of doing business in the automotive OE market.

Ford Motor Company's Supplier Research Program is a new approach to this problem. As Charles Nave, the program coordinator, has pointed out, "it provides a formalized system to facilitate discussion of advanced product needs and of program strategies between Ford management and suppliers " (90). The program enables Ford to direct suppliers' R&D efforts into its areas of greatest need, gain valuable R&D input from suppliers, and cut down on the time between new product development and actual mass production. Suppliers benefit from more

contact with FMC, increased awareness of its advanced product needs, greater share of split sources business, sharing development costs, and possible priority status in bidding (may get business though not lowest bidder) (90-92).

While reducing the risk and cost of new product development borne by the supplier, this program also may give rise to non-market mechanisms in the auto maker-supplier relationship. The rise of custom work for auto makers and the nurturing of a close symbiotic relationship may discourage competition and increase the cost of the automobile. Furthermore, some important suppliers have shied away from Ford's Supplier Research Program because of proprietary rights problems. Obviously, these issues need to be resolved.

C. What Can the Federal Government Do?

Finally, there is a possible role for the federal government in encouraging the auto suppliers to initiate technological innovations in the automotive industry. There are many areas that call for attention.

First, there is the acute problem of product liability and the consequences of its being unresolved as yet—soaring premiums for product liability insurance, costly recalls of defective parts, and enormous outlays for testing and quality control (93-95). A recently released federal report on the product liability problem will hopefully provide legislators with enough information to resolve some of the issues (95).

The government is also currently discussing several international trade issues with the Japanese. The Japanese steel industry is being investigated for alleged violations of U.S. antitrust and tariff issues (42). Meanwhile, the U.S. government has introduced a reference-price system to protect the domestic steel industry from the cheapest imports and is pressuring the Japanese to liberalize their trade restrictions (96,97). Concessions by the Japanese could mean the opening up of a previously inpenetrable market to U.S. auto suppliers.

Antitrust activity of the Justice Department is another area where the

government could influence the auto supply industry. The Justice Department has not yet made a final ruling on the antitrust suit concerning Fruehauf's acquisition of Kelsey-Hayes. The decision will hinge on how much collaboration the government is willing to allow and whether the supply industry's competitiveness is adversely affected. Another antitrust suit has been filed by Carborundum Co. in an attempt to block Eaton Corporation's takeover bid. In still another test, LTV Corporation and Lykes Corporation, two faltering steel conglomerates, are trying to merge. Normally, this action would be swiftly met with an anti-merger suit, but the Justice Department is under enormous pressure to take a "soft antitrust stance" to help U.S. steel companies compete with imports (98). A similar argument could be made for the U.S. auto makers and suppliers who compete with foreign firms that are allowed to participate in cooperative business ventures. For instance, in the European market, U.S. companies must compete with IVECO, "a consortium of European automotive equipment and vehicle manufacturers (Fiat, OM, Lancia, UNIC, Magius Dentz) who have combined their resources to become an efficient network of international manufacturing and marketing" (50).

Mandates from various regulatory agencies (NHTSA, EPA, and OSHA) are reportedly raising problems for suppliers. A great deal of criticism has been voiced by the auto supply industry on the inconsistency in regulation and enforcement, conflicting rules from one agency to the next, unnecessary duplication of forms and information required by various agencies, and the persistance of obsolete regulations. The industry is calling for the regulatory agencies to do more cost-effect and side-effect studies before imposing regulations to minimize their inconsistency. This would help reduce the volatility of the industry as well. Mechanisms to update and revamp regulations and to coordinate the activities of the various agencies are also sought by many in the industry.

Finally, there is the prospect that the government could provide direct

incentives for innovation. In recent years, government expenditures for R&D have not kept up with inflation, which may account for the publicized slowdown in the pace of U.S. technological innovation (70). The government has taken a stand that the industry can do much of its R&D with its own capital. Some contend that more coordinated government procurements and federal funding of auto industry research and development programs could help the companies meet the myriad government regulations. NASA'a Technology Utilization Office, responsible for "transferring innovative ideas and technology from NASA's aerospace programs to industry," has not had a significant impact on the auto industry(99). Companies originally involved in aerospace markets have taken it upon themselves to bring advanced aerospace electronics and primary materials technology to the auto industry.

Besides increasing agency budgets for research and development, the government needs to study how it "might significantly effect the investment and market decisions that ultimately determine research and development" (100). The apparent failure of the Experimental Technology Incentives Program will hopefully not be a deterrent for future efforts in this direction (100). Gaining a better understanding of the innovation process would enable the government regulatory agencies, the auto makers, and the auto suppliers to reduce the risks and costs of innovation. This in itself would be a major step forward for the auto industry in its attempt to reduce emissions, improve fuel economy, maximize driver safety, and hold costs in line.

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APPENDIX E

CODING SHEET FOR EVALUATION QUESTIONNAIRE

ON

CONSUMER IMPLICATIONS OF TECHNOLOGICAL CHANGE

IN THE U.S. AUTOMOBILE INDUSTRY

Workshop on Consumer Implications of Technological
Change in the U.S. Automobile Industry

Evaluation Questionnaire

Coding Sheet

Your candid remarks on this seminar will greatly assist us in planning future programs. Please return the completed questionnaire to us before you leave.

1. Program Content

A. Did the program equal, exceed, or fall short of the expectations you had prior to attending the program?

1 = exceeded
2 = equalled
3 = fell short
4 = don't know

B. Was the subject matter useful to you?

1 = yes
2 = somewhat
3 = no
4 = don't know/no answer

C. What other areas of the seminar subject might have been dealt with?

1 = costs
2 = innovation
3 = manufacturer - dealer relations
4 = less emphasis on aftermarket
5 = alternative to automobile
6 = none or no answer
7 = fewer topics
8 = more depth
9 = no comment
10 = liability
11 = regulatory process
12 = implications of regulated change
13 = more discussion of capital goods
14 = more emphasis on long range planning
15 = other
16 = incentive
17 = proprietary rights
18 = more international investment and technology transfer.

D. What might have been omitted?

1 = damageability
2 = less consumerism
3 = energy discussion
4 = more issues of immediate concern to automakers
5 = bus problem
6 = deisel discussion
7 = none
8 = don't know
9 = no answer
10 = eliminate regulation discussion
11 = fewer issues discussed
12 = morning session
13 = bilaterla trade problems

E. Was the organization of the topics within the session appropriate?

1 = yes
2 = somewhat
3 = no
4 = don't know/no answer

F. Was the workshop supported as effectively as possible with:

1. the materials sent ahead of time?

1 = yes
2 = no
3 = somehwat
4 = no answer
5 = should have received report ahead of time

G. Was the program of about the right length?

1 = too short
2 = yes, about right
3 = too long
4 = no

2. Moderators

A. Were the moderator(s) effective?

1 = yes
2 = somewhat
3 = no
4 = don't know/no answer

B. What changes, if any, would you recommend in this area?

1 = no answer
2 = more emphasis on research topics
3 = topics to be discussed should be sent out ahead of time
4 = fewer topics
5 = better moderator
6 = distributors should be represented
7 = better use of lunch period
8 = discussion should stick more to topics
9 = none

3. Participants

A. Was the mix of participants appropriate in terms of background, experience, interest in the subject, and ability to contribute in discussions? If not, could it have been improved?

1 = yes
2 = somewhat
3 = no
4 = don't know
5 = yes, except would like unions included

B. What would you consider to be the optimum number of participants for a seminar?

1 = 10-20
2 = 20-30
3 = 30-40
4 = 40-50
5 = no answer

4. Administration

A. How would you rate the overall administrative handling of the seminar?

1 = excellent
2 = good
3 = fair
4 = poor
5 = good except for bus to conference
6 = no answer

B. Did arrangements for meals, accomodations, etc., seem well planned and coordinated? Was the quality of meals and accomodations acceptable?

1 = yes
2 = somewhat
3 = no
4 = don't know/no answer
5 = exceptional

C. What changes or improvements would you suggest?

1 = none or no answer
2 = fewer topics
3 = case study didn't relate to topic
4 = smaller group
5 = bus to conference
6 = more telephone capacity
7 = one more day
8 = mail materials out earlier

5. Additional Comments

A. Please add any further comments you may have regarding the program, moderators, administration or accomodations.

1 = it was a pleasure to attend
2 = more focus on research
3 = topics not well-defined ahead of time
4 = good to have dinner night before to break the ice
5 = too much emphasis on consumerism and not enough on alternative solutions to auto.
6 = tried to do too much in a day
7 = good to get different groups together
8 = group should be broken down into smaller groups to "work"
9 = none or no answer

Optional

Please give your name and affiliation if you wish.

Name ______________________________

Organization ______________________________

Thank you very much.

Seminar:

1 = consumer
2 = supply
3 = research & development
4 = international

Type of respondent:

1 = business
2 = government
3 = academic
4 = other
5 = no name or affiliation given

APPENDIX F

TWO ILLUSTRATIVE NEWS ARTICLES

JOSEPH M. CALLAHAN

AUTOMOTIVE INDUSTRIES MAGAZINE

insight/analysis DETROIT

Joseph M. Callahan
Editor

A Harvard Symposium On Auto Regulations

About 120 auto officials, congressmen, government regulators, university professors, self-styled consumer advocates and a few newsmen recently gathered for a two-day Symposium on "Government and the Automotive Future" at Harvard's Graduate School of Business Administration.

Many participants expected this meeting to be a waste of time, assuming it would largely consist of scholarly but theoretical papers by educators, defensive comments from the auto men, impractical polemics from the consumerists and technology-forcing requests by the regulators.

All of these elements were present in varying degrees. But gradually this seminar evolved into something originally envisioned by Harvard Professor William Abernathy and Dr. Richard John, chief, Energy Programs Div., U.S. Department of Transportation, which funded the meeting.

Industry critics repeatedly expressed their prejudices, suggested that criminal charges should be made for bad designs and literally convicted the auto men on a wide variety of unsubstantiated charges. On the other side, someone said that "all regulators are ignorant."

But it slowly began to dawn on quite a few participants that this forum was made up of the best collection ever gathered of all the divergent and conflicting elements that form the power structure that has in past and will continue to formulate and administer the nation's automotive regulation.

The voice heard more during the two-day meeting probably was Rep. David Stockman's. He's a 31-year-old congressman from Michigan's fourth district who repeatedly came down hard on the bureaucrats and was extremely critical of the nation's emissions, safety and mileage regulations. He even predicted that the 27.5 mpg (11.7 kml) standard for 1985 might have to be lowered.

Counteracting Stockman to a degree was Joan Claybrook, head, National Highway Traffic Safety Administration, who made the closing address. Typically, she scorched the auto companies in her speech for not innovating and then commended them in her informal remarks for making a lot of "exciting" progress.

During the ten sessions the speakers usually first discussed the suggested topics, even though they were often irrelevant, lame-duck subjects. Then, subsequent audience-participation sessions invariably turned to substantive, worthwhile debates.

While everyone was able to pick up new, worthwhile information, the Symposium offered particular opportunities for the auto men. They were able to present the automotive "case" to many neutral but influential people, to better understand the many powerful influences arrayed against them and to sharpen their skills for presenting the automotive arguments.

A few automotive officials were still embittered at the end. But Dr. David Potter, GM's environmental vice-president, said, "This is where future legislation starts. Some of these people will have different ideas in the future. That's why we supported this Symposium."

Listen to Joe every Monday through Friday at 6:45 P.M. over WJR Radio, Detroit

AUTOMOTIVE INDUSTRIES, December, 1978

Joseph M. Callahan

Harvard And The Auto Free-For-All

Almost the full spectrum of American and overseas thinking on the future of automotive regulation was presented in a two-day verbal free-for-all at Harvard University's Graduate School of Business Administration.

Labeled the "Symposium on Government and the Automotive Future," the meeting of some 120 congressmen, federal officials, college professors, consumerists, auto officials and newsmen reached no conclusions and took no actions. Nor was it expected to.

Instead, the symposium served as a forum for a wide variety of views on many subjects relating to automotive regulation. Opinions ranged from deregulation to substantially more regulation. Specifically, one U.S. congressman proposed backing off from the 27.5 mpg (11.6 kml) standard for 1985, while some of the regulators discussed the possibility of increasing corporate average fuel economy to 50 mpg (21.2 kml) in the 1990s.

The auto companies were subjected to a good deal of whipping

As expected, the auto companies were subjected to a good deal of whipping by some bureaucrats and educators. On the other hand, the auto establishment also received considerable support and actually came out on top in many of the rough verbal skirmishes.

One missing element in most of the sessions was any recognition that many Americans are now saying "enough" to any further regulation.

The principal addresses were given by John J. Fearnside, deputy under-secretary, Department of Transportation; Dr. Umberto Agnelli, vice-chairman and president, Fiat; Rep. Ray Thornton, (D-AR) chairman, Science, Research and Technology Subcommittee; Joan Claybrook, head, National Highway Traffic Safety Administration; Prof. Richard Rosenbloom, associate dean, Research, Harvard Business School, and Rep. David Stockman (R-MI).

Many U.S. government departments and bureaus had one or several representatives at the meeting. Conspicuous by its absence was the Environmental Protection Agency (EPA), an agency whose ears should have been burning as the result of the severe criticism heaped on it. However, Eric Stork, former top EPA official on vehicle controls and now a visiting fellow at Purdue University, was on hand.

Five vice-presidents and numerous representatives of the auto companies attended. Among these were Dr. David Potter, GM's group vice-president, Public Affairs; Harold McDonald, Ford engineering vice-president; Will Scott, Ford vice-president, North American Government Affairs; Lewis C. Veraldi, vice-president, Advanced Vehicle Development, and Sydney Terry, Chrysler vice-president, Public Responsibility and Consumer Affairs. Sixty participants either presented papers at the symposium or served as moderators, and all the participants were encouraged to ask questions or present their views at sessions.

"The Government might have to relax its tough emissions and fuel economy standards"

Stockman, a freshman congressman who previously served on congressional staffs for six years, possibly stirred up the most interest by saying that the Government might eventually have to relax its tough automotive emissions and fuel economy standards.

In a well-informed and often humorous manner, Stockman ripped into the pollution standards, pointing to their lack of scientific justification and to the evidence of vast national pollution that's popping up around the nation. He also predicted that the government may have to back off from the 27.5 mpg (12.7 kml) mileage standard.

Stockman declared, "As more evidence comes in and more studies are done and the medical basis for the original criteria document is assessed, I think a case can be made for substantially or at least significantly relaxing the primary ambient standard for oxident."

Regarding the mileage standards, he said that their principal purpose was to reduce the flow of money out of the country and to save consumer money. However, he said the skyrocketing costs of the nation's auto downsizing program was making those standards poor investments.

Stockman, who has jousted previously with DOT officials as a member of the House Commerce Committee, said some of them tried to have him eliminated from the Harvard program, which is largely funded by an $80,000 DOT grant. The fact that Stockman still participated says something for the integrity of the symposium, which was organized by Prof. William Abernathy, Harvard's Graduate School.

Claybrook arrived at the end of the symposium and in her prepared speech made a scorching attack on the auto makers for not innovating enough, except when forced by government regulation. Repeatedly calling the industry a "shared monopoly," she cited a 10-year-old study which said the industry spends the lowest number of dollars as a percent of sales on research of any industry, adding that if the auto companies were smaller they'd do more innovating.

She also criticized U.S. auto makers for practically forcing their suppliers to come up with innovations and for letting foreign auto companies lead in innovations.

After again criticizing the annual

auto model change, Claybrook said, "The companies avoid like the plague any mention of improvement which might ameliorate the so-called 'externalities'—health and safety damage—claiming that any mention of them might scare customers away."

However, she reversed her position somewhat when subsequently asked how the auto makers were now handling federal regulations, saying they were doing many good things.

"If it's one thing the auto industry wants from its designers, it's to have a planning process and expected schedules"

"The auto industry has decided in my view," she said, "that the safety, emissions and fuel economy regulations are very important to them because they serve as a source of stability to the public demand for these kinds of benefits. Without the regulations, there would be constant new demands that they would have to meet at unexpected schedules. If it's one thing that the auto industry wants from its designers, it's to have a planning process and expected schedules.

"So I think in the last year and a half they have made these acknowledgements rather readily. I also think that they are making some important, good steps. Several of the companies—Ford, General Motors, Chrysler and some imports—are going to put passive restraints in cars in advance of requirements. They are experimenting with the whole design of the restraint system which has been a bug-a-boo of the safety program from the beginning."

It was apparent that the meeting's organizers, in setting up the program, were groping for ways of coming to grips with the major issues in the large and multi-faceted subject of automotive regulation. Many of the requested addresses were wide of or completely off mark. Fortunately each speaker was requested to give just a brief summary of his paper. Then, the sessions were opened to the audience and the talk frequently turned to the substance of the regulatory situation.

A notable exception was one long period in which the speakers endlessly discussed the feasibility of an "effluent tax" in which each factory, power plant and vehicle would be annually taxed in proportion to the pollutants it emitted. This, naturally, would call for annual short emissions tests on the nation's 145 million cars and trucks.

Charles E. Nash, special assistant to Claybrook, publicly pondered why EPA received so much more criticism than DOT and other regulatory agencies. There seemed to be about 120 answers to this question, but no one was present from EPA to respond.

After Stockman leveled a few barbs at the pollution regulators, Stork said, "You (Congress) brought it all on yourself. You told EPA to implement air standards with less than zero risk. You also said it will be 0.4 gr of NO per mile. When you get into that detail, you loose the opportunity to determine how much risk is zero risk.

"I think the law is ridiculous in detail. You should have given EPA broad policy guidelines on what should have been done and then checked back on how we were doing."

Stockman, who was a student at the Harvard Divinity School when the Clean Air Act of 1970 was enacted, could only shrug.

The subject of innovation came in for a great deal of discussion from the educators and bureaucrats. The auto men largely sat back and smiled at this point, as they did through most of the sessions. No one bothered to mention the difficulty for either companies or individuals in being creative and innovative when the government's got a gun at the engineer's head, a fire at his feet and a third group of bureaucrats forcing him toward bankruptcy with fuel economy standards and recall notices.

Thornton who was sympathetic to the automotive problems, was asked about his vote for the President's recent energy bill which imposes the "gas-guzzler" penalties on some cars.

He asserted, "I think it was a duplication of the past (mileage standard) law. I voted for the bill because it was time to show we are serious about doing something on the energy situation. It's a tax which needs not ever be imposed if the manufacturers move fast enough."

"Is the auto industry purposefully thwarting the regulatory effort"

Dr. David Ginsburg, a Harvard Law School coordinator of the symposium, expressed strong dissatisfaction with the auto regulatory process and asked, "Is the auto industry purposefully thwarting the regulatory effort?" He then discussed three ways of stimulating more automotive innovation—breaking up the companies, federal chartering of the automotive companies, as Ralph Nader has urged, and putting public representatives on their boards.

In the end, he rejected these proposals and said, "It would seem necessary to free the regulatory process from its dependence upon the handful of regulated firms for the development of technologies that it is not in the interest of those firms to advance.

"If other firms in other industries find it too risky to take up the task, the only alternative to the government's doing the necessary R&D is to lower the risk and raise the incentives facing the considerable potential sources of innovation outside the automobile industry."

auto NEWS/ANALYSIS

"At those meetings a bird should step out of a cuckoo clock every 15 minutes and yell 'B.S.'"

One auto official said privately, "At those meetings a bird should step out of a cuckoo clock every minute and yell 'B.S.'" Another hoarsely whispered, "It's amazing how little these fellows know about what's going on and how little they understand the auto industry."

Nevertheless, the professors continued with their academic, theoretical discourses, well supported with large charts that reduced some of the more obvious major developments to tiny boxes, all neatly linked together. Some admitted that everything they knew about the situation came from reading newspapers, while others declined to acknowledge their sources.

Third party participation (experts outside the government and industry) in research came in for much discussion. Several speakers belittled this idea, saying there were no experts around who still hadn't lined up either with the government or the industry on pollution and other subjects.

No one recalled that the auto and oil industries and EPA had a well functioning, fairly impartial research organization, APRAC (Air Pollution Research Activities Council), operating a few years ago. But Senator Edmund Muskie (D-ME) persuaded EPA to drop out on the flimsiest of pretexts.

Speakers from auto companies overseas also participated in the fray. Fiat's Agnelli said that, despite the great deal of clamor by outsiders for automotive innovation, his company's experience is that it doesn't pay because the public has minimal interest in it.

The U.S. favors harmonization," or standardizing safety and emission standards for cars around the world

NHTSA's Nash said the U.S. favors "harmonization," standardizing safety and emissions standards for cars around the world.

But Dr. Ulrich Seiffert, chief safety engineer of Volkswagen AG, Germany, said that America passed up its opportunity last year for harmonization. He said U.S. standards were far too advanced for other automotive countries. The "last year" reference apparently dealt with DOT's standard calling for either air bags or passive belts in 1982-84. Seiffert also discussed the automotive standards agreed on in Europe. Representatives of the Japanese auto industry also spoke on several issues.

At one juncture in the symposium, Dr. R. Eugene Goodson of Purdue University, raised the question of why the nation's entire energy program thus far largely consists of the emphasis on automotive fuel-economy standards, especially since there's no proof at this point that all the auto makers will be able to meet them.

Symposium director Richard Johns noted the emphasis on fuel-economy standards is at the behest of Congress

Richard Johns, probably the prime mover behind the Harvard symposium, said that thousands of pages of congressional testimony show that this is the approach that Congress wanted and this was expressed in the mileage standards of the 1975 energy law.

Johns added that thus far the mileage standards have been "enormously successful." However, he raised a flag of caution over the possibility of Congress again forcing the auto makers to double the mileage of their cars in the years after 1985.

He said the rejection by many public groups of the truck mileage standards last winter was a warning sign on the horizon about the future acceptability of this approach, although he predicted that similar mandatory standards will probably be again chosen.

Johns also called attention to the fact that, from the standpoint of fuel saved, it would only be half as worthwhile to set 25-50 mpg (10.6-21.2 kml) standards, as it is to set 12.5-25 mpg (5.3-10.6 kml).

GM can afford spending for mileage standards but other U.S. companies are finding it difficult going

Seemingly, President Carter and other government officials are increasingly concerned with the enormous expenditures the mileage standards are requiring of auto companies. General Motors can afford this spending, but other U.S. companies are finding it difficult going.

This was reflected in comments by DOT's Fearnsides who said that the President and DOT Secretary Adams were concerned about the decline of innovation in the industry. Seemingly, the Administration feels the multi-billion costs of downsizing can be avoided, if only there's enough innovation.

But Dr. Norman Alpert, manager of environmental health programs at Exxon Research and Engineering Co., restored a bit of common sense to the discussion by saying, "There's no 'magic stick' in fuel

economy. The only real 'big stick' is weight reduction.'' He added there's a great need to reduce the adversary relationship between government and the auto industry to improve the nation's overseas trade performance.

Prof. Joseph L. Bower, Harvard Business School, brought up the subject of deregulating the auto industry. This apparently was viewed as "too far out" by everyone. However, it should be noted that the deregulation of the airline industry actually began with some studies at Harvard that were later sold to Congress by Senator Edward Kennedy (D-MA).

GM paid $2 billion in federal taxes last year

The principal auto-industry response came from Robert McCabe, director of the GM Treasurer's Office, who began by saying he represented a firm that paid $2 billion in federal taxes last year.

Among the points McCabe made was: (1) GM has innovated with the catalytic converter and other worthwhile devices, (2) Business Week magazine had accurately noted in a recent issue that "the hostile government climate stifles innovation," (3) government regulations have increased each car's cost by $800 and, (4) some of GM's smaller competitors are being hurt more than GM is by current regulations.

"General Motors spent $3.6 billion last year to meet government standards," he continued. "For the future it's estimated that we'll have to spend $5 billion a year, and this is scaring the hell out of us."

He also said that rather than spending these billions for downsizing cars, it might be more worthwhile to the nation to use the money for developing synthetic gasoline.

"As for the federal sponsorship of R&D," McCabe continued, "The difficult question would be 'Who'll judge the worth and the marketability of each innovation?' Developing something in the laboratory is one thing, but mass producing 10 million copies of it is a different matter."

Summarizing, he said that GM acknowledges the need for innovation, but these innovations must have good cost-benefits and it's important to retain the competitive nature of the U.S. auto business.

Despite all the conflicting and discordant notes there were enough plusses for DOT's Fearnsides to say similar symposia will be held in the future, although not at Harvard.

APPENDIX G

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